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LOCOMOTIVES, TRACTION & STATIONARY ENGINES, BOATS, WORKSHOP, PRODUCTS, CLUB NEWS & EVENTS, REVIEWS

In This Issue:
- A 7¼ inch gauge V/*LINE* G class Loco
- Build a Traction Engine Riding Truck
- Marine Plant - Burners and Boilers

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The Cover

The Box Hill Miniature Steam Railway Society's G class 7¼" gauge loco. This loco answers the club's need for motive power not affected by total fire ban days.

Photo: Keith Bain

Australian Model Engineering

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Psst!... did you hear about...

A portion of the introduction for new readers below states: ...you can experience the great fellowship that makes our hobby special.... I believe that this statement is true — it *is* a special hobby. I have never experienced an incident that would make me "run-for-the-hills". The hobby of model engineering is one that allows a freedom of expression in many ways. Primarily it is an art-form, as we recreate miniatures of objects that remind us of different times.

Freedom of expressing views and opinions — as well as miniature objects — is also a fundamental aspect of the hobby: most model engineers would agree with this. My concern is with an extremely small minority who seek to undermine the fellowship aspect of the hobby — those who actively engage in rumour mongering. Those who start false rumours are not only hurting themselves, but also the hobby in the eyes of fellow modellers, and the public.

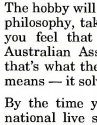
Some clubs are beginning to feel the detrimental effects of false gossip, there is a letter in this issue regarding one club in particular. However, this club is only one of a couple who are at the mercy of false and sometimes damaging rumours. I hope the trend stops: before too much damage is done.

You can help by not passing on information you are not sure about. May I suggest that if you hear a rumour about a club, or a situation that you are not sure about: please approach the administration of club concerned and ask for the real story — before you pass on the rumour to someone else.

The hobby will survive, but why make it difficult. If you disagree with a club's philosophy, take it up with the club directly — I am sure they will listen. If you feel that the problem involves many clubs: take the issue to the Australian Association of Live Steamers or the New Zealand equivalent, that's what they are for! Don't stew over it and then resort to under-handed means — it solves nothing.

By the time you read this, the dust will be settling after the Australian national live steam convention in Townsville, Queensland. It is a time of renewal of friendships and a time of growth as we see the achievements of the twelve months since the last convention. Carry the experience into the next twelve months: continue to help the hobby grow.

Brian Carter



To our new reader

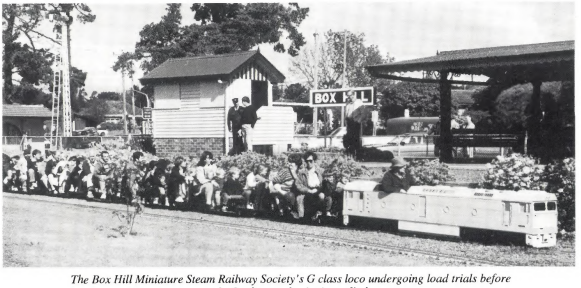
If this is your first issue of Australian Model Engineering, welcome!
We hope you'll look forward to the ideas, news and camaraderie in each bi-monthly issue.
One of the great things about our hobby is the way model engineers actively help each other. Unless you live in an isolated community, you'll soon discover who has valuable experience in your field of interest, or who will help you to make a part that's too big for your workshop machinery. Look in the *Club Roundup* section to find a club that's near to you; visit the club and you'll usually find model engineers who live not too far away. Then you can experience the great fellowship that makes our hobby special.
This magazine is prepared in the same spirit of "model engineers helping each other". About two dozen people put many hundreds of hours work into each issue — all on a voluntary basis — to help model engineers in Australia and New Zealand keep up to date and keep in touch.
We rely on our readers to write articles for us — for the same (non-existent) rate of pay! If you have ideas or techniques that you feel would be interesting to others, please drop us a line. We'll gladly help with preparation of artwork or editing if that's necessary. Most important of all, please support the people who advertise in our magazine. Without them to pay the bills, you wouldn't be reading this!

Brian Carter

Our other loco — the "G"

by Keith Bain

Photos by Keith Bain and Kenneth Weeks



The Box Hill Miniature Steam Railway Society's G class loco undergoing load trials before the final coat of paint is applied.

While the name of our club is the Box Hill Miniature Steam Railway Society Inc., and we enjoy seeing steam locomotives "huffing and puffing" around our track, we share our fun and games with the public on a fairly regular basis. In the past, if one of those days had fallen on a day of total fire ban, we would have been forced to abandon that day's run. So in 1989 the Club decided to build a diesel-outline locomotive.

We considered the method of propulsion and soon decided we would use a petrol engine from a small car coupled to a variable-flow hydraulic pump, which in turn would be connected to a hydraulic motor in each of the bogies.

Next came the question: which life-size loco should we select to model? The decision was made easy by our need for a wide body to accommodate the petrol engine. The Victorian "G" Class with Co-Co wheel arrangement was therefore selected. The two six-wheel bogies give excellent draw-bar pull and very good braking, while the straight sides of the body provide the maximum width for the engine and equipment without distorting the external appearance of the locomotive.

One of our members had a 1500cc Ford Cortina engine hidden away in his back shed. It was from a car that had been driven only to church by the proverbial "little old lady" since a complete overhaul. As the price was very reasonable and the engine tested out A1, our primary source of power was soon decided!

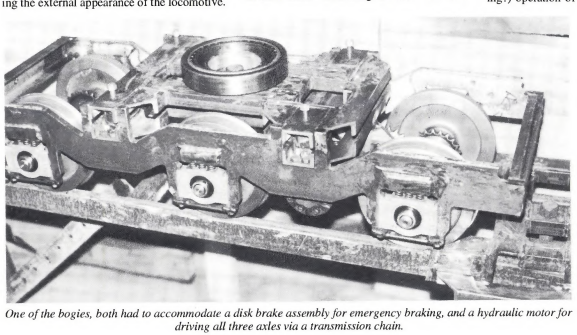
Bogies

Work now started on the difficult task of designing the bogies. Each had to accommodate a disc brake assembly for emergency braking and a hydraulic motor for driving all three axles via a transmission chain with an in-built chain- tensioning device. The task was ably carried out by one of our most dedicated members, Ken Constable.

Though we had no detailed drawings of the full-size loco, we were able to take many photographs of it and were also able to obtain some outline sketches which we dimensioned to the scale Ken finally selected. Determined by the need to fully enclose the Cortina engine within the cab, the scale turned out to be 2.125 inches to the foot.

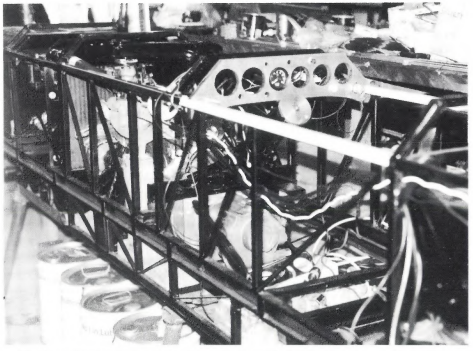
The first components of the bogies, the four sideframes, were cut from 12 x 102 MS flat plate by the "drill and cut" method — probably the most arm-weakening (wrecking?) operation of the whole job! The slides for the horn blocks were extended by welding additional metal to the sideframes and bending them to form the correct profile. "Take- up" type plummer blocks were used as axleboxes by cutting away the protruding sections normally used for hanging the block and drilling countersunk bores ⅛" deep in the top of the block for spring location.

The bogies were fabricated in two sections like those on the original locomotive and are of all-welded construction, using 50 x 25 MS rolled



One of the bogies, both had to accommodate a disk brake assembly for emergency braking, and a hydraulic motor for driving all three axles via a transmission chain.

channel between the sideframes. On each bogie, pre-machined plates were welded to the frames for mounting the hydraulic motor and chain-tensioning sprockets; the photographs show the detail). The main frames (the lower section of the bogie) carry all the motive and braking equipment, while the upper frames are used to spread the load of the loco between the three axles of each bogie. The upper and lower frames are separated by rubber blocks, which also soften the suspension. Two used Timken® tapered roller bearings "scrounged" from an earth-moving company were used as roller paths for the location of the bogies to the frame of the loco. A set of stops was fitted between the bogies and the loco frame to stop them from "jack- knifing" should the bogies derail.



The frame showing the Cortina engine, radiator and hydraulic pump mounted in position.

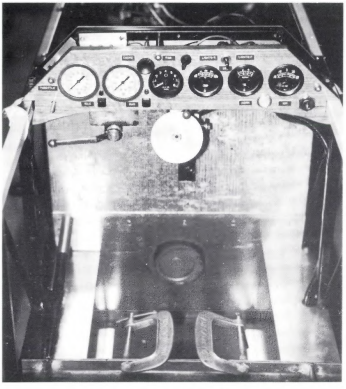
Loco framework

The base of the main loco frame was fabricated from 102 x 51 MS channel and is 3657mm (12ft) long by 552mm (21.75 inches) wide, with the balance of the frame being cut, formed and welded from 19 x 19 x 1.8 rolled hollow section steel. The original cross-member from the Cortina car was welded into the main frame and suitably strengthened to form the front engine mount. The rear of the engine (to which would be fitted the hydraulic pump) is supported by a beam across the rear of the bell housing; all four mounting points to the frame are through rubber mounts. Frame cross members were placed for mounting the radiator, locating the driver's seat and the two bogies, the last being fabricated from 102 x 51 MS channel with supports running to the front and rear of the main frame. From the longitudinal supports, a framework was welded to carry both the couplings and a support (or "crash bar") which would rest on the rails should the loco derail, thus avoiding damage to the pilot ("cow-catcher").

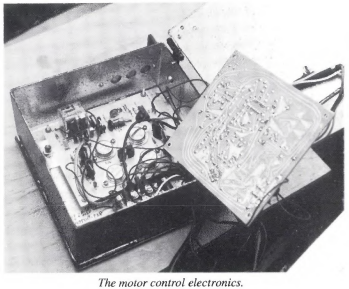
The thought of petrol dripping on to a track over which steam locos continually drop their hot ash gave us cold shivers. As a safeguard against this possibility, a tray was made and positioned in the frame under the petrol tank. This tray is considered an absolute necessity.

The hydraulic tank with its 100 litre capacity was fabricated and mounted at the front of the loco, while the petrol tank (also fabricated) was located behind the driver at the rear. It was considered that the weight of 100 litres of oil at the front would help to balance out the driver's weight, and that the fuel tank at the rear would be away from both the heat of the engine and any ignition sparking that might accidentally occur. The original radiator from the car was located within the cab in the front of the engine, and the engine was fitted with a multi-bladed fan to provide maximum air flow. We believed that if we were going to have any trouble, it would be with the cooling of the motor because of its total enclosure within the cab. Provision was also made for the installation of an electric fan in the roof beneath one of the imitation air vents. Initially this fan was to push air through an oil cooler before the air was sucked through the engine radiator.

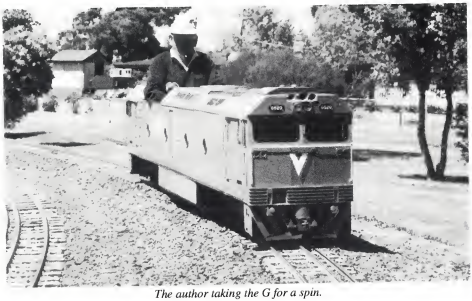
The exterior sheet-metal panelling was ably formed by Geoff Swindley, who fol-



The instrument panel and driver's controls.



The motor control electronics.



The author taking the G for a spin.

lowed the details of the full size loco's form as closely as practicable. While allowing for modifications to provide access to the petrol and hydraulic oil tanks, it was also necessary to provide somewhere for the driver to be comfortably located. Our thanks go to Geoff for doing a job not one of us was looking forward to: the compliments for the finished product should be mainly directed to him!

Hydraulic power unit

The decision to use hydraulic propulsion made it necessary for us to obtain the help of a qualified engineer with the experience to design the hydraulic circuit and detail the equipment required to do the job. Norman ("Mac") Crane, a friend of one of our members, came to the rescue and soon had us "on the right track". A Southscott Series 33 Mk1 pump was purchased and mounted to the bell housing of the engine, taking particular care to have virtually no mis-alignment between the engine and the pump: a tolerance of plus or minus 0.001" over the 8" diameter was permitted. Any undue misalignment would have caused leakage within the pump and would have lowered both its efficiency and period of service.

This pump is a variable-flow type and is valved internally to provide both forward and reverse flow to the motors. As a zero-flow position has to be held accurately while the loco is stationary, it was decided to control the pump output by a screw control and handwheel. Interlocked with this screw control is a second control which allows three positions:

(1) from stop to full forward,

(2) from stop to full reverse, and

(3) stop, or zero flow from the pump only.

In position (3), a switch is interlocked to ensure that the engine can only be started in this position. This overcame our concern that, should the engine be able to be started in either of the other pump positions, the loco could be set in motion accidentally.

A large capacity, renewable-cartridge-type oil filter was built into the hydraulic circuit and an oil cooler fitted under the electric fan previously mentioned. In the event of a breakdown it was realized it would be necessary to "break" the hydraulic circuit, so a by-pass valve was fitted, located in the driver's compartment. With the by- pass valve open, the loco can be manhandled or towed if necessary. The loco may also be left with the engine running and the emergency brake on without any fear of a "runaway". With the by-pass closed, the speed and power of the loco is directly related to the flow of oil (governed by the pump setting) and the rev/min of the Cortina engine.

An Eaton Charlynn H-Plus series motor, with a capacity to consume 4.5 cubic inches of oil per revolution and 600 rev/min maximum, is fitted to each of the loco bogies. At its maximum rev/min, the loco is geared to a top speed of 10 kilometres per hour.

The Southcott pump must be restricted to a maximum of 3000 rev/min. Since the Cortina engine is quite capable of at least twice this speed, some form of control had to be fitted to the engine to safeguard the pump. The answer to this problem came from Ken Constable when he designed, built and installed a "cruise control" system which governs the engine to the requisite 3000 rev/min. The throttle consists of two buttons to switch the "cruise control" on and off, and a rheostat, which electronically controls the engine's speed range from idle (1000 rev/min) to maxi-

The completed G class loco posing with its proud builders, L to R: Ken Constable, Geoff Swindler (the designer) and Keith Bain.

mum (3000 rev/min). While some teething troubles were experienced with the unit, Ken's persistence has sorted them out and the control system now works satisfactorily.

Exhaust system

One of the more difficult items to design and build to fit within the confines of the cab was the exhaust system for the engine. Space was at a premium and it was impossible to fit a conventional muffler without spoiling the outline of the model. In desperation, I gathered together some pieces of 102 x 51 RHS and a section of curved 38mm outside diameter exhaust pipe. I welded them together to form one vertical section at the outlet end of the exhaust manifold and two horizontal sections of RHS along the side of the engine (all joined together with 38mm pipe), finally exhausting out the side of the loco just behind the leading bogie. This system was a complete gamble, as it was not known how the system would affect the efficiency of the engine, nor what the exhaust tone would sound like. When the engine was eventually "fired up", to the surprise of all, the exhaust note sounded quite like the real thing — sheer fluke! The only adverse effect of the exhaust system is the additional heat confined around the engine and the pump.

In service

The first trial runs of the loco indicated that we could possibly experience trouble on a hot day with engine overheating. As the basic reason for the loco's construction was to replace the steam locos on a day of total fire ban, modifications had to be made to the cooling system. It was decided as a first step to run the electric fan continuously. This presented no problem as the engine had been fitted with an alternator, so that long idling times with the fan operating should not adversely affect the battery. Next, a shroud was fitted around the engine's fan to enclose the rear of the radiator, thus providing maximum air flow through the radiator. The air is then ducted from the engine compartment through panels on each side of the compartment, thence through ducting under and along the sides of the driver's compartment.

It was also found necessary to lag the petrol line to the engine to prevent the fuel from boiling. The overheating problem now seems to be under control.

The real test will come on a day of total fire ban — which we have yet to encounter. The loco has been painted and suitably signwritten in VicRail V/*Line* colours, and has been accepted as a most attractive and serviceable model by all who have driven it or ridden behind it. We are not sure of its maximum pulling capacity, except to say that on a public run day, hauling five cars carrying 40 passengers around our track, the hydraulic system is loaded to 600 psi. From this, we estimate the "G" should haul in excess of 100 passengers. Maybe one day we will really load it up and find out!

Vic Rail's V/*Line* G class Locomotives

By Mark Carney

Photos by Mark Carney and Les Mouat

The Victorian G Class were born 15 October 1984. These Clyde Engineering built locomotives, GM Model JT26C-255 numbered about 33 in the class. The G class are rostered to work heavy freight and fast passenger work throughout the state of Victoria as well as South Australia on the Broad gauge. V/*Line* have several standard gauge bogie sets that are fitted to various G class bodies for the run into the Sydney metropolitan area. The Gs work high speed freight trains from Melbourne through to Sydney.

National Rail

There are rumours that this type of loco will haul the trains for the National Rail Corporation (NRC). At present, NRC trains travel through to Brisbane changing engines at Clyde or Flemington yards with NSW State Rail Authority's 81 class or electric locomotives for the trip to Broadmeadows Yard. If 81s are used, the train continues onto the Brisbane metropolitan area at Arcaica Ridge Yard.

As an SRA driver with over twenty years experience working all types of diesel and electric locomotives on freight and passenger trains, I find the G class locomotives pleasant to drive. The cab is very well laid out with all of the controls easy to operate.

From a model engineering viewpoint, a G class loco would be easy to build because of its straight panels and flat surfaces [You can soon purchase aluminium bogie castings for a 5" gauge version of the G class from AME... bmc].

Speed Vs power

The gearing for the G class gives it legs like a greyhound: making it ideal for fast light freight and passenger work. The low gear ratio of the 81 class however, likens it to a draught horse, making it ideal for heavy freight work. The harder you work a diesel the better it handles the load.

Although the VR G class and the NSW SRA 81 class locomotives share a similar heritage, there are many differences that the discerning modeller should be aware. The following text describes many internal and external variations between the two classes of locomotives.

Some differences between the G and 81 class locomotives

- The low and high tension ground fault lights are located within the 800 amp starting fuse cabinet on the G class, but is located within the main high tension contactors cabinet on the 81 class.
- The 81 class has D77B type traction motors, where the G class has D87, a traction motor which is much heavier in wiring and insulation, compared to the D77 and D77B. The heavier wiring and insulation allow the traction motor to withstand the heat and high amps, somewhat better compared to the D77B. 81 classes are currently being refitted, with major overhauls and failures.
- The ground relay on a G class is of a conventional type, with the reset button in the cab, where the 81 class has an ARL (automatic reset limiter) resetting the ground

G 519 at Junee NSW, a 422 class loco is just barely visible coupled behind. The smooth features of the G class are clearly shown in this view.

A G class (left) and an 81 class (right) meet face to face. The G class decided to curtsy by sliding its bogie off the rails. Many variations of the front-ends can be seen in this view.

A front view of G519 showing many of the features listed in the "differences" section.

relays automatically when shutting the throttle back off.

- Speedo generator mounted on No1 axle on the G class, and mounted on No2 axle on the 81 class. Both on the driver's side.
- Dynamic cut out switch on the G class is in the form of a toggle switch with a seal, whereby an 81 class has a slide switch.
- G class has an electrical cabinet inside No1 cab, 81 class has an electrical cabinet inside the cool room compartment, No1 end.
- The G class also has a small electrical cabinet separately to the main electrical cabinet inside the cool room compartment at No1 end, near the AR11, housing some main high voltage contactors. The 81 class has all electrical contactors housed in the main electrical cabinet.
- The G class locomotives possess an AR11 alternator whereby the 81 class has an AR16. The alternators are significantly different in the an AR11 changes the windings within the alternator at approximately 40kph. This is known as a "generator transition", and basically changes the windings from parallel to series parallel within the field windings (main rectifier stators) of the alternator.

The companion alternator being housed within the alternator and rectifier is also different in output being a D14 or CA5 on the G class, and a D18 with the 81 class AR16.

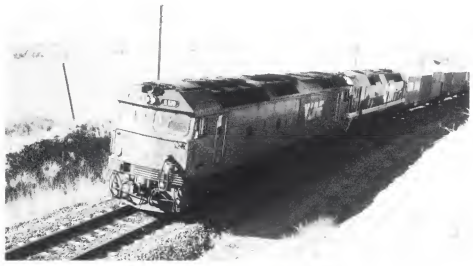
Due to the G class being a "transition type", a separate module has been placed in the module annunciator panel. The TR103 is a separate module and does not exist on 81 class locomotives. The TR module has two functions, firstly to control the transition within the alternator from parallel to series parallel, and series parallel back to parallel.

And secondly, to take the role of the WO module as a G class does not possess a WO module. While the 81 class having a non transition type alternator, does not possess a TR module but houses a WO module (wheel overspeed) module.

- 81 class has Vic/NSW change over vigilance switch on the air rack. G class has it mounted in the cab.
- 81 class filter blower is mounted up in the roof above the AR16 alternator. Where the G class filter blower is mounted up in the roof in the back area of the electrical cabinet mounted above the battery box.
- G class has batteries mounted in a large hood in the cool room compartment, where the 81 class battery box is mounted under the unit's body next to the fuel tank.
- The stop button on an 81 class is mounted inside the engine cool room compartment on the electrical cabinet. Where the G class stop button is mounted in the cab.
- The G class has the facility to cut out traction motors, a facility the 81 class does not possess.
- The G class has the brake pipe hose on both driver's and observer's side.
- The G class sand reservoirs are not only located in quite smaller bins on the side of the body but also incorporated into the cow catcher. The 81 class only having the sands incorporated in the side of the body.
- The most significant difference in the cab is probably the layout of the control stand and seating arrangement, the 81 class locomotive seat sits more in toward the centre of the cab, where the G class sits right next to the window. This itself makes shunting difficult with the 81 class due to the position of the seat but makes the visibility quite good. For the G class the biggest drawback is that having a seat right next to the window, you are prone to the drafts and air leaks. The speedo sits in view of the left eye restricting the view somewhat. Also due to the layout of the control stand you tend to have your arm cocked right back when operating the throttle on the G class. The cab is restricted when moving around in the G

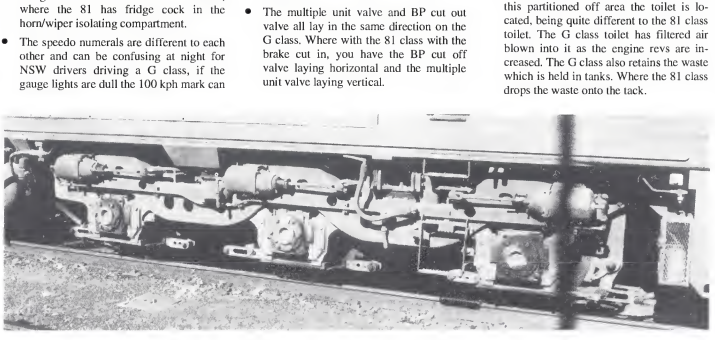
class. There are two inspector seats mounted on the wall of the electrical cabinet.

- The G class has twin wiper blades, which provides good visibility in the wet. The 81 class only has a single blade each side.
- The G class also has twin door handles compared to the single door handle on the 81 class. The twin door handles are especially good, being able to open the door from ground level.
- The G class has a larger hot plate than the 81 class, but is not as efficient as the 81 class hot plate.
- The G class has a cooler with a section incorporated inside the cooler for at water cooler, having an external tap on the outside of the cooler. The 81 class just having a cooler.
- G class switches inside the cab are all located differently to the switches in the 81 class.
- The air gauges on the G class are slightly different in that the G class has two Independent brake cylinder needles in the one gauge. With the brake pipe needle being in its own gauge.
- The 81 class differs in that there is only one Independent brake cylinder needle and both brake pipe and Independent brake cylinder needles are incorporated in the same gauge.
- The Independent brake cylinder light is red on a G class, whereby on an 81 class and other NSW engines the light is blue.
- The G class air condition is mounted in the cab above the roof. Where the 81 class has a separate air condition unit at each end, which is ducted to the cab, making it look much neater.
- Fridge cock is external for the G class, where the 81 has fridge cock in the horn/wiper isolating compartment.
- The speedo numerals are different to each other and can be confusing at night for NSW drivers driving a G class, if the gauge lights are dull the 100 kph mark can be confused for the 80 kph mark on an 81 class, therefore a driver can think that he is only doing 80 kph when in fact he is doing 100 kph.
- The G class is able to turn on the rear headlight from the front cab, 81s can't.
- Marker lights are on the driver's side on the G class, compared to the observer's side on the 81 class.
- The G class has a reverser receptacle near the floor which is provided for Victorian examiners, to lock the reverser in the receptacle, eliminating the chance of the driver moving off. Later 81 class (units running into Victoria) are fitted with this receptacle.
- The driver's brake valve is on the left side on the 81 class and is on the right side of the G class. With this the regulating nut is also on the side of the respective brake valves.
- The multiple unit valve and BP cut out valve all lay in the same direction on the G class. Where with the 81 class with the brake cut in, you have the BP cut off valve laying horizontal and the multiple unit valve laying vertical.



G and 422 classes double heading in the Junee area.

- The G class also has a power manual control in front of the driver, a feature the 81 class only has from 8181 to 8184.
- The G class fuel tank holds a capacity of 9600 litres where the 81 class has only a capacity of 6600 litres. Due to the significant differences in the size of the fuel tanks, the G class has the batteries inside the cool room of the engine compartment, where the 81 class mounts the batteries in a large battery box next to the fuel tank under the body.
- The main reservoirs are also different with the G class housing a main reservoir tank, each side of the fuel tank, where the 81 class main reservoirs are positioned together beside the fuel tank.
- The No2 end of the G class has an extra partition between the cab door and the main engine room. This partition makes the G class much quieter to drive. Also in this partitioned off area the toilet is located, being quite different to the 81 class toilet. The G class toilet has filtered air blown into it as the engine revs are increased. The G class also retains the waste which is held in tanks. Where the 81 class drops the waste onto the tack.



A close up of the G class bogie, somewhat less cluttered than the 81 class bogie.

- Hand rails on 81 class locomotives slope inwards, G class hand rails are mounted and flushed into the body—making alighting from 81s slightly easier.
- 81 class locomotive body is quite different compared to the G class. The roof on an 81 class slopes and angles downwards to the front of the cab. Where G classes retain the boxed shape. 81 classes tend to show a more streamline effect. The side of a G class is quite flat and plain, where an 81 class shows its tubular construction and strength. The front portion of the G class is quite different having an appearance of being very squarish, and a pleated section at the buffer level of the front.
- The main centre pin of the bogie which the body sits on the bogie, sits between 1 and 2 and 5 and 6 axle on a G class, where on an 81 class the centre pin is on 2 and 5 axle centrally placed upon the bogie. The bogies are quite different with significant difference in the wear plates, snubbers and centre pins.
- The radar units are mounted in different manners. The 81 class having a more professional look to its mounting. Where the G class has a very constructional form of mounting.
- The dismounting step, mainly the first step, is different on a G class to an 81 class. The 81 class being much easier to alight.
- The G class having a large ball type valve mount in a pipe near the cow catcher No2 end, for the purpose of dispelling the waste.
- The engines are basically the same, the 81 class unit has a 645 E3B where a G class has a 645 E3C these blocks being almost identical except the G class dipstick is on the opposite side to the 81 class.
- The prime/start lever on an 81 class, is replaced by a prime/start button on the G class. The later G classes having a pre lube button also included.
- The port hole windows on the G class are more evenly spread out along the units body, where the 81 class port holes are not as evenly distributed. The 81 class having two port holes much closer together No2 end.
- Several 81 class locos now have the large double doors in the side of the body to the engine room. The units being 8181-8184 and 8175. They also have the large flutes above the companion alternator to disperse the heat.
- The whistles of the G class are significantly different being much lower in tone compared to the 81 class. The G class still possessing the conventional cord to blow the country horn and a paddle for the city horn. Where the 81 class now having the joystick type lever to blow the whistle.
- The G class has the facility to have the main reservoir drain valve in automatic or manual. This is achieved by simply turning the valve anticlockwise or clockwise. The 81 class is permanently in automatic.
- The G class still has the ratchet type parking brake. Where the 81 class has the main reservoir air operated parking brake. Parking brake cylinders are mounted on the bogies.
- There is considerable difference when walking through the engine rooms. The G class being much cleaner and easier to move around the engine room. Where the 81 class can be difficult when wishing to go over the turbo/auxiliary side of the engine as you have to climb the crank shaft cover plate.
- Also there is considerable difference when walking in the coolroom compartment. The G class being much more simpler, where the 81 class you have to step down and around the air rack.
- G class has vigilance emergency button whereby if the vigilance fails the observer is required to press an air operated button every 2 minutes for a duration of five seconds.
- G class in length over the coupler are 20.7m long where the 81 class is 21.156m long.
- The port holes in the side of G classes are much lower than 81 classes.
- The wheel slip light on a G class is red where the wheel slip light on an 81 class is white.
- The 3 and 7 independent cocks are located behind the cowcatcher, where the 81 class cocks are on there respective pipes at the front of the catcher.
- The brake cylinder cut-out cocks on a G class are on the driver's side No1 end, where the brake cylinder cut-out cocks on the 81 class are on the observer's side No1 end.
- The water tank for the toilet and hand basin on a G class has a filling pipe both sides and an overflow on the observer's side No2 end, where the 81 class only has a filling and overflow pipe on the driver's side No2 end only.
- The uncoupling device on an 81 class runs from the observer's side to the drawgear, where the G class uncoupling device runs right across and can uncouple the drawgear from both sides.
- The 81 class has a small stubby buffer where the G class possess none.
- The G class has twin wiper washer bottles at each end on the same side, where the 81 class has a single wiper washer bottle both beneath the driver, behind the cow catcher at each end. (e.g. No1 end driver's side, No2 end driver's side).
- G class compressor filter sits vertically where the compressor filter on an 81 class sits horizontally.
- G class, even with a bigger fuel tank, is 1½ tonnes lighter than the 81 class.
- G class now has 10 second delay when set up selected (dynamic), the 81 class remains unmodified.
- G class speedo works and records with Eng Cont Switch in 'Start', the 81 class is intended to be modified likewise.
- There are no condemning lines on G class wheels.

Although this article is mainly about the G class locomotive, it is difficult to separate this class from its sister class—the NSW SRA 81 class. These rather lengthy comparisons are for those considering modelling a G class model without confusing some details with the 81class.

8120 fresh from the paintshop in 1988, sporting the bi-centenial colour scheme.

A Hernia-saving Traction Engine Riding Truck

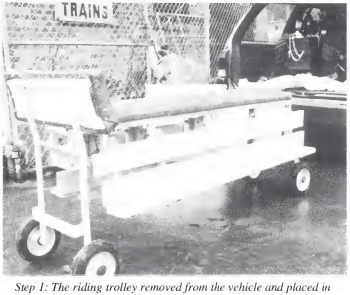
Story and photos by Doug Baxter

When I completed John Haining's *Countryman* Durham and North Yorkshire traction engine in 3"-to-the-foot scale, it weighed 330 pounds or 150kg. I managed to load it into the VN Holden station wagon with the aid of a couple of painter's planks — but only just! There were a few alarming moments, and it took a lot of effort. Unloading proved worse. It was then that I decided an easier, safer method was necessary.

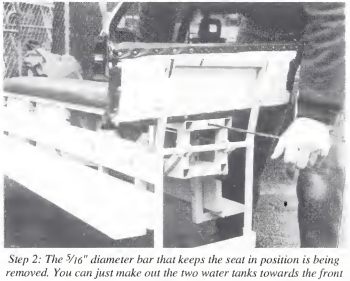
After a few nights of doodling on paper the trolley/ramp design became a reality. I settled on a design that would be a combined unit. Primarily a riding trolley to tow behind the traction engine. However for a short time — at the beginning and end of each run — a ramp to make easy work of transferring the traction engine in and out of the station wagon. Some of the space between the frames has been used to provide additional water capacity in the form of two tanks. The end result was very pleasing, the traction engine can now be safely transferred to and from the vehicle without any back-breaking fuss!

Designed to fit

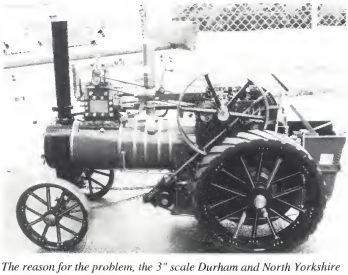
The front height of the driving truck was governed by two factors: the height of the station wagon floor, and the depth of the driving



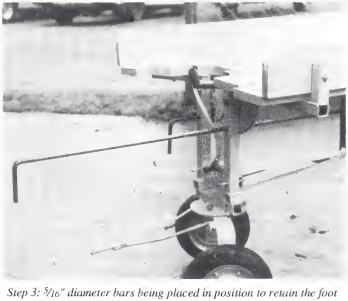
Step 1: The riding trolley removed from the vehicle and placed in position for conversion to the unloading ramp.



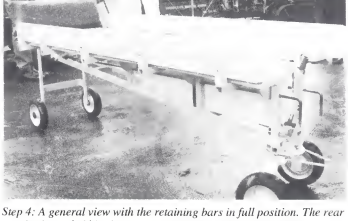
Step 2: The 5/16" diameter bar that keeps the seat in position is being removed. You can just make out the two water tanks towards the front of the frame interior.



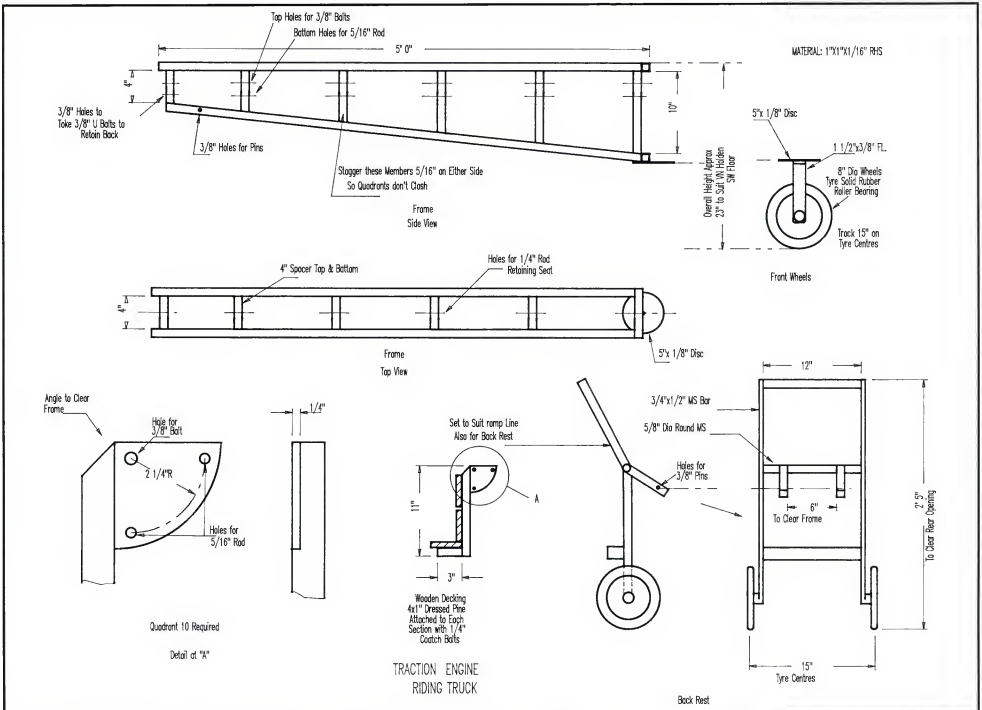
The reason for the problem, the 3" scale Durham and North Yorkshire traction engine. The whistle is a full-size version and sounds great! I was once requested — at a school fete — not to blow the whistle as it frightened the children.



Step 3: 5/16" diameter bars being placed in position to retain the foot rests in the horizontal position.



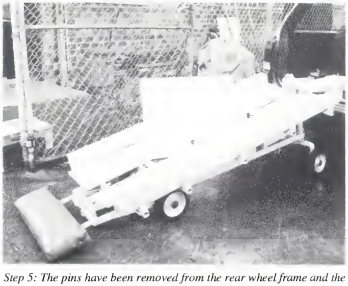
Step 4: A general view with the retaining bars in full position. The rear wheels are held in the vertical position by pins located at the foot support second from the end.


Top Holes for 3/8" Bolts
Bottom Holes for 5/16" Rod
5' 0"
MATERIAL: 1"X1"X1/16" RHS
3/8" Holes to Take 3/8" U Bolts to Retain Back
3/8" Holes for Pins
10"
Stagger these Members 5/16" on Either Side So Quadrants don't Clash
Frame
Side View
Overall Height Approx 23" to Suit VN Holden Sill Floor
5"x 1/8" Disc
1 1/2"x3/8" FL.
8" Dia Wheels Tyre Solid Rubber Roller Bearing
Track 15" on Tyre Centres
Front Wheels
4" Spacer Top & Bottom
Holes for 1/4" Rod Retaining Seat
Frame
Top View
5"x 1/8" Disc
Angle to Clear Frame
Hole for 3/8" Bolt
2 1/4"R
Holes for 5/16" Rod
1/4"
Quadrant 10 Required
Detail at "A"
Set to Suit ramp Line Also for Back Rest
11"
A
3"
Wooden Decking 4x1" Dressed Pine Attached to Each Section with 1/4" Coatch Bolts
3/4"x1/2" MS Bar
5/8" Dia Round MS
Holes for 3/8" Pins
12"
6"
To Clear Frame
7'-5"
To Clear Rear Opening
15"
Tyre Centres
Back Rest
TRACTION ENGINE
RIDING TRUCK

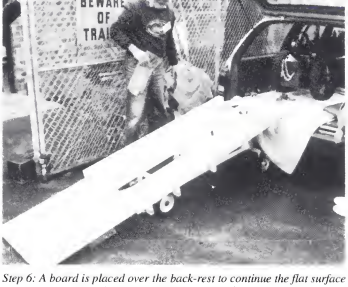
truck's footrests in the horizontal position (which is one inch wider than the rear wheels of the traction engine). The overall length and width were governed by the available space remaining in the station wagon when the traction engine is in position on one side of the vehicle.

The driving truck was arc-welded using 2.5mm electrodes. All holes for the retaining rods were drilled before assembly, but it was necessary to ease a few of them with a round file due to the usual welding distortions. Having a few 5" x ⅛" discs on hand, I used them for the turntable and fitted an oil nipple to the top disc. The 8-inch solid rubber wheels, fitted with roller bearings, were purchased. The pins retaining the seat back-rest in its travelling or vertical position cannot come out while the foot rests are in the travelling position, as the 4 x 1 inch decking prevents their movement. A suitable drawbar was attached to the 1½"x ⅜" front axle support.

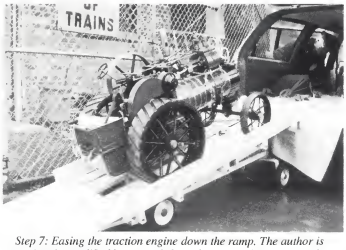
The seat is 6"x 1" dressed pine, 5 feet long, upholstered with foam rubber and vinyl. It's retained by the ¼" diameter rod passing through two brass angles attached to the bottom behind the second cross-member in front of the fourth member. The back-rest is similar to the seat, being about 24 inches long and retained by two brass Z brackets to allow it to slide down. It was found that this rest was becoming damaged by the engine wheels, so the board shown in the photos was placed over this area.



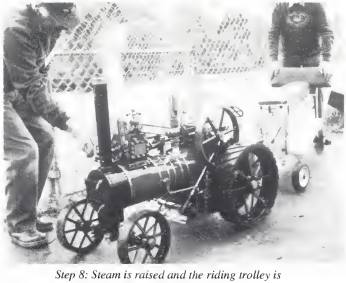
Step 5: The pins have been removed from the rear wheel frame and the frame folded under. The front of the ramp is level with the floor of the wagon.



Step 6: A board is placed over the back-rest to continue the flat surface and to protect the padded back-rest.



Step 7: Easing the traction engine down the ramp. The author is operating the modified boat winch from the near-side passenger door. You may be able to see the cable connecting the engine to the winch.



Step 8: Steam is raised and the riding trolley is connected to the engine.

A solid anchor

A sheet of particleboard just covers the floor area of the station wagon with the rear seat folded down. Attached to the front left hand side is a boat winch to which I added a safety pawl to make it safely rotate in both directions — unloading and loading the traction engine. Some 12 feet of ¼" diameter steel cable is used for the operation.

The traction engine is retained in position by three sets of automotive lap-type safety belts: one each at the front axle and through the rear wheels, the third over the boiler.

The trolley is kept in place by a restrainer. All these are attached to clips, etc., on the particleboard. It was found necessary to anchor the board in position by attachments to the lugs which hold the driving truck's passenger seat in its correct position, as it tended to slide out when the engine was in the inclined position.

Without all the pushing and shoving while trying to get the engine in and out of the car, it is possible to relax with a good day's steaming!

Novel Mounting of Circular Firebox Doors

by Harold Wilkes as told to Murray Lane

Photos and drawings for publication by the author

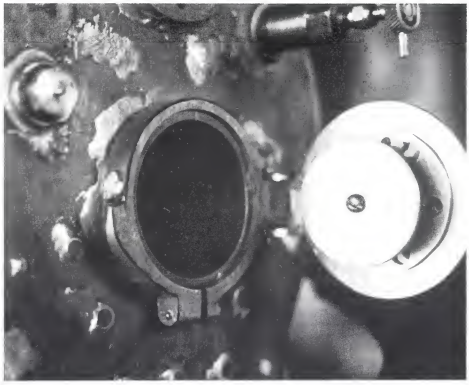
From the workshop of Harold Wilkes, a member of the Manukau Live Steamers in Auckland NZ, comes a simple method of fixing the firebox door assembly to the backhead of the boiler. This design has several advantages over the normally made doors:

- No additional plates need to be welded to the backhead.
- No tapping for screws into the backhead is required.
- Fitting and removal is very simple.
- A variable air control is included.
- When the door is opened, a catch holds it in place.

The drawings and photographs are self explanatory, but a few additional words will help with the construction.

When constructing the boiler, extend the firebox door tube so that at least 7.5 mm is proud of the backhead. If cladding and insulation is going to be added, add the extra thickness to the 7.5 mm.

The pin in the frame door hinge is part of the catch system to hold the door open when firing. This pin and the one on the damper lock can be silver soldered in place. The position of the slot in the end of the catch, to hold the door in a suitable position, can be determined by a trial fitting on the boiler. This is a handy device to have on a swung door, as there is nothing more frustrating than having a door continually swinging shut when shovelling coal into the firebox. A spring fitted to the door pivot will do the same thing.

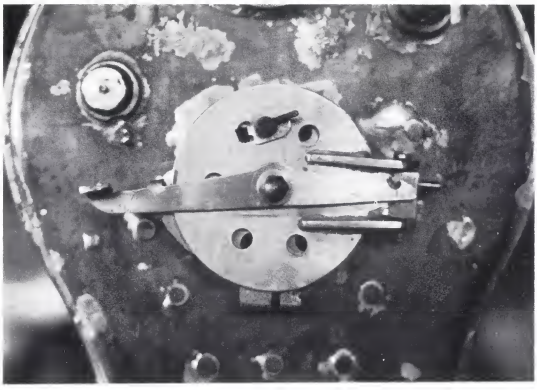


This photo shows the novel mounting method. It also shows some of the detail on the back of the door

I have one fitted to my *Speedy*. Once the latch is released the door swings open on its own accord. Bend the lever door hook to suit the latch on the frame so that the door is held shut firmly when the lever is pressed down.

If the door frame is a neat fit on the firebox door tube, a hacksaw cut through the frame will provide a slot wide enough to allow clamping. If it is somewhat loose, mill a wider slot with a slitting saw. If the weld run around the firebox door tube is rather heavy, it may be necessary to file a chamfer on the back of the door frame.

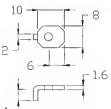
This design of firebox door can easily be modified to fit any engine with a circular door, providing the firebox door is extended during construction.



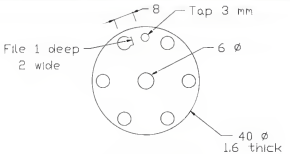
A good view of the door front, showing the catch and the air control detail.

Cross section through typical firebox door hole.

M 3 * 5 bolt

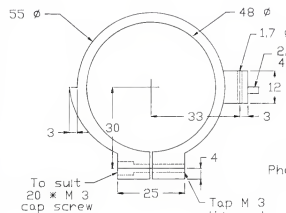


DAMPER CATCH



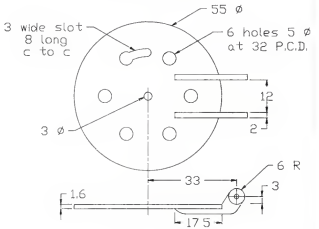
INNER DOOR

DAMPER LOCK

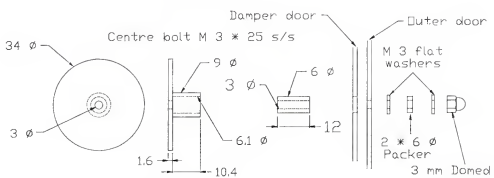


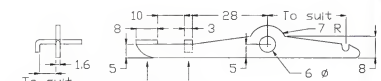
FRAME

Phosphor bronze



OUTER DOOR





LEVER

HEAT DEFLECTOR

BUSH

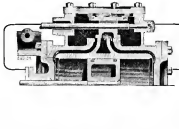
All parts except frame are made of stainless steel.

When building the boiler allow an extra 7.5mm of the firebox tube to stick out proud of the backhead, more IF cleading is fitted, so that the firebox door frame can be clamped to it.

DETAILED DESCRIPTION
Clamp on firebox door assembly for Martin Evans design for 5" gauge GNR 2-8-0 Nigel Gresley locomotive

NOTE! This firebox door design could be used for any engine with a round firebox ring. Modify dimensions to suit.

DESCRIPTION	SCALE
FIREBOX DOOR FOR 5" NIGEL GRESLEY LOCO	
DRAWING BY HAROLD HEWES	DRAWING NUMBER
DRAWN BY MURRAY LANE 26/5/94	NG1



Steam Chest

with Dave Harper

Hi there steamers, the last couple of months seem to have flown by, there seems to have been so much going on. As a consequence I haven't got around to going over another one of the Raadschelders engines. I guess it'll wait for another issue.

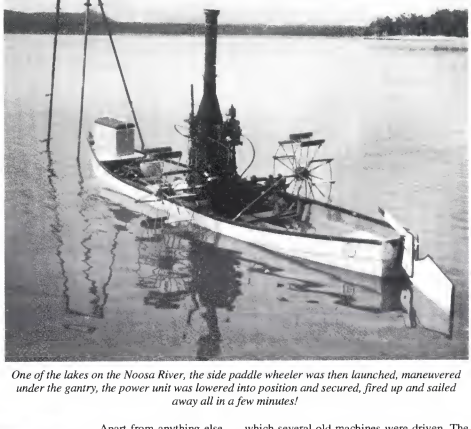
What I did turn up whilst looking for stuff for this issue was a set of photos passed on to me some time ago of a most unusual little steamboat.

Portable paddle wheeler

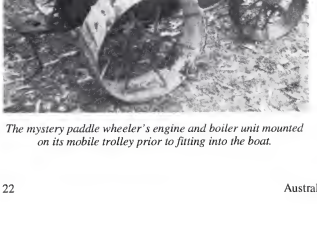
The photos were taken on one of the lakes on the Noosa River, up on the Sunshine Coast, by the daughter of one of my friends! Apparently she watched this boat being assembled and sailed away, and knowing dad's interest in anything to do with steam, she dutifully took a series of photos. Unfortunately she didn't think to ask the gentleman concerned his name, or any details of the boat!

Apparently the engine and boiler unit was wheeled into the water on its trolley, and hoisted up on the gantry. The boat was then launched, maneuvered under the gantry, power unit, lowered into position and secured, fired up and sailed away all in a few minutes!

This bloke is obviously pretty well organized, and if any of our readers out there happen to know him—he may even be a reader—please ask him if we can do a proper article on his boat!



One of the lakes on the Noosa River, the side paddle wheeler was then launched, maneuvered under the gantry, the power unit was lowered into position and secured, fired up and sailed away all in a few minutes!



The mystery paddle wheeler's engine and boiler unit mounted on its mobile trolley prior to fitting into the boat.

Apart from anything else, the trolley looks suspiciously like an unfinished model traction engine, but the whole setup is more model size than full size anyway.

More steam jaunts

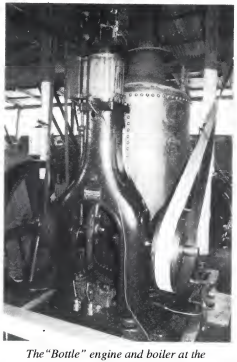
On Australia Day, 26 January, I joined a goodly crowd of people visiting the Caboolture Historic Village, about 30km north of Brisbane. The village is home to several local groups, including an active branch of the Antique Machinery Restoration Society of Qld.

Scattered among their several sheds are a number of very interesting steam exhibits, which I duly photographed for your edification. Firstly, I found a delightful vertical engine and boiler unit fully restored and running. It was powering an overhead layshaft, from which several old machines were driven. The engine, which I think would be called a bottle type, was built by Shanks, in the UK about 1880. It has a bore of 8" and a stroke of 11½".

It's mounted, with its boiler, on a cast iron base which doubles as a water tank, a fairly common setup of the period. It not only forms a safe base for the firebox but also acts as a feed water heater! The feed pump is driven from the valve eccentric, visible in the photo behind the oil cans.

This unit drove a firewood mill at Southport originally, then from 1897 to 1943 it drove an arrowroot mill! That's not a bad innings for one engine. It is now owned by George Parr of AMRSQ, who kindly supplied this information.

Also hooked up to the boiler is a very nice inclined-cylinder steam winch—I believe it's also owned by George Parr. It was locally built by Evans, Anderson and Phelan, of Brisbane, around 1916, for Hutton's Bacon Factory in Zillmere, a Brisbane suburb. Later it was moved to a slipway on Cabbage Tree Creek not far away, and spent the rest of its life hauling boats in and out of the creek. It was running as sweet as a sewing machine



The "Bottle" engine and boiler at the Caboolture Historic Village.

A well preserved inclined-cylinder steam winch at the Caboolture Historic Village.

while I was there, a tribute to its builders and the restorers!

Steam saw mill

The other item I was intrigued by was the steam powered sawmill, now fully operational after several years restoration. I wasn't able to get a history of the sawmill, but was told that the makers name seems to have been ground off the single cylinder horizontal engine, so its origin is a mystery.

Despite that, it runs well, and drives the collection of flapping flat belts without trouble. The table drive is fascinating, consisting of two multi-Vee pulleys driven in opposite directions. When the centre, driven, pulley is engaged one way or the other by the operator's boot pushing the lever, the friction drives the table in the required direction.

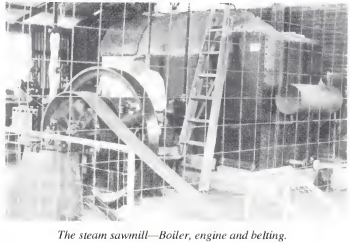
Apparently this form of multi-Vee friction drive was quite popular around the 1920s. I'd be interested to hear from anyone with more information on the system. The pulleys in question can just be seen in the photo between the spokes of the big gear wheel.

All in all, it was a most enjoyable day out, and thanks to all the people at Caboolture who made it possible.

A Gold Coast hideaway

A couple of weeks after the Australia Day outing, I headed south with my old mate Kel, to look up Bob Weir. He is a retired mechanical engineer who recently saw the light and

The steam powered sawmill, table drive



The steam sawmill—Boiler, engine and belting.

The sawmill's single cylinder horizontal engine

settled himself and his wife in the Gold Coast hinterland.

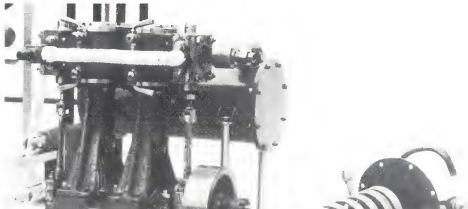
Bob has kindly offered to write some articles for us on his modelling activities, and requested help to photograph a model Babcock and Wilcox boiler unit that he had stripped down to overhaul.

Needless to say, I didn't take much persuading, and was happy to tote my camera bag along, even happier when Kel agreed to drive us!

Bob had a real globe-trotting career, and has a fund of stories to tell. He is also a very proficient model maker, and it was a pleasure to look around his immaculate workshop and take the necessary pics.

The photo I've used here is of the Stuart twin 10 engine that is powered by the B&W boiler. The condenser behind it is a dummy, and actually contains the coil seen on the right which acts as a feed water heater—very neat!

Look forward to seeing Bob's articles in future issues! And thanks for a great day, we'll be back!



Bob Weir's Stuart twin 10v engine, the coil on the right acts as a feed water heater when it is in place in the cylinder behind the engine.

A guide to crossheads part two

Last issue I started off this series with the early beam engines with their chain and quadrant drive, then on to Watt's parallel link motion.

The next stage of development was pioneered by Richard Trevithick, the Cornish Mining captain. He is best known for producing the first practical steam locomotives, both for the road and on rails. He was in fact a prolific inventor, and between 1790 and 1815 developed his "high pressure" steam engine for all sorts of purposes, as well as producing water powered pumps and starting the first tunnel under the River Thames.

Eventually he was lured to Peru by the prospect of pumping out gold mines, and suffered the same fate as many others, before and since! A combination of non-existent roads, poor labour and political unrest ruined him, and he ended up penniless in Columbia. There, by one of those stranger-than-fiction coincidences, he bumped into George Stephenson's son Robert, who had suffered much the same fate, although Robert managed to get out intact. Robert loaned Trevithick enough money to get back to England, but Trevithick's health never fully recovered, nor did his career.

The first successful locomotive

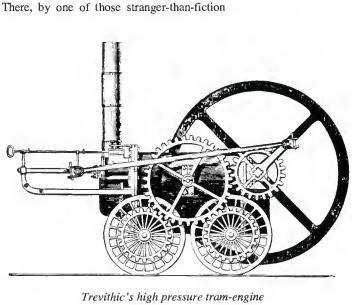
Enough of the history lesson... Trevithick's *Pen-y-darren* locomotive of 1804 is generally accepted as being the first successful steam railway locomotive, even though it only ran a few times, and the engine was later used to drive a drop hammer! The problem wasn't with the loco but with the track. The cast iron rail sections simply couldn't stand the weight of the loco and kept breaking. This problem wasn't really solved until about 1825 when George Stephenson introduced wrought iron rails onto the Stockton and Darlington Railway. Only then could the heavy locomotives be used regularly enough to permit proper development.

However, Trevithick produced his "high-pressure" locomotive with the single cylinder set horizontally into the front of the boiler. The piston rod drove a crosshead that ran the full width of the machine. Two parallel rods projecting forwards guided the crosshead, while the connecting rods were connected to the outer ends. The drawing gives the general idea, it is reproduced from Samuel Smiles' Life of George and Robert Stephenson, published in 1879. One of my recently acquired treasures!

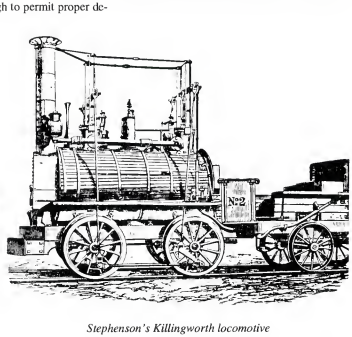
Stephenson's solution

George Stephenson used a similar system, used vertically, on his Killingworth locomotive in 1816, as seen in the next picture, from the same book.

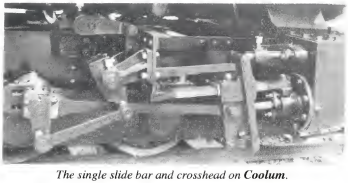
An almost similar idea showed up in a mystery engine pictured a few issues ago, and again here. It is a twin cylinder engine with extended piston rods running in outboard



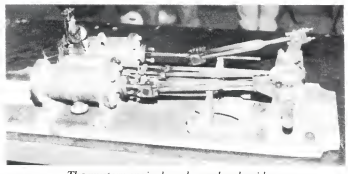
Trevithic's high pressure tram-engine



Stephenson's Killingworth locomotive



The single slide bar and crosshead on ***Coolum****.*



The mystery engine's rod crosshead guide.

bearings. Stirrup shaped con rods transmit the power around these bearings.

With the development of the planing and shaping machines, mainly by James Nasmyth, in the 1820s, flat sliding surfaces could be produced. This led to the development of the rectangular bar crosshead widely used on small locos, and seen in the photo of *Coolum*, the Fowler cane tram loco mentioned in last issue. The guide consists of a massive brass bar, about 4" x 1", with the crosshead clamped around it. It is, of course, much simpler to adjust flat surfaces to take up wear.

The next stage of development seems to be the double bar guides with the crosshead between. We'll look at those next issue, until then, happy steaming!

with Dave Harper

Hi there book lovers. I'm writing this before the first Bookchat reached our readers, so I've no idea what the reception will be. However, as our Editor seems to feel it's worth a go, I'll carry on for now.

Book one

A long-standing must for every modeller's bookshelf, the *Model Engineers Handbook* by Tubal Cain, published by Argus Books. Now in its second edition, this book contains in its 176 pages all those little bits of information that you need in a hurry, but can never find. Like weights and densities of different woods and metals, screw thread shapes and sizes and so on. It also contains many useful formulae and basic trig tables plus countless other bits of data. For anyone even mildly interested in model engineering, this book will be about the best money you'll ever spend!

Book two

The next book is rather more esoteric, but it's one of the best reads I've had, one of those books that leaves you feeling really good. It is the *Autobiography of James Nasmyth* as edited by Samuel Smiles. It was originally published in 1884, but has been reprinted by Lindsay Publications in both paperback and hard cover editions. I purchased the paperback edition some time ago, and read it straight through.

Nasmyth was one of the band of British engineers who, from 1800 to about 1850 revolutionized the engineering industry in Britain, and eventually, the world. He is best known for his invention of the steam hammer, but he was a prolific inventor, a fair employer and saw himself as a benefactor of humanity by his inventions, and didn't bother patenting most of them. Instead, he would send copies of his drawings to anybody he thought may be interested!

Born into a moderately wealthy family — his father was a famous portrait painter — he suffered neither the grinding poverty of George Stephenson, nor the poor health of James Watt. His was truly a life of hard work and happiness.

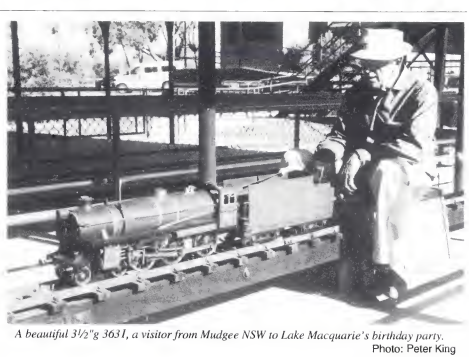
Nasmyth tried to become an apprentice to the famous Maudsley, but was instead taken on as Maudsley's personal assistant, so much did he impress the great engineer! After three years with Maudsley, Nasmyth started his own business in Manchester. He did so well that the great Patricroft Foundry became an institution, and he was able to retire a wealthy man at age 48. He was then able to indulge his passion for astronomy, building his own telescopes and outdoing many professional astronomers of the day.

There is a *Chronological List of Inventions and Contrivances* at the end of the book which is a great tribute to this engineering genius who deserves wider acclaim. This book will appeal to anyone interested in how the machines he uses were developed.

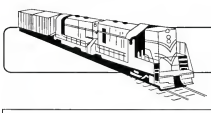
Lindsay Publications are to be congratulated on their efforts in reprinting these old and rare books, when will they do Smiles' *Lives of the Engineers*?

Book news and reviews are requested from readers, I don't want this to be solely my soap box!

Happy reading.



A beautiful 3½"g 3631, a visitor from Mudgee NSW to Lake Macquarie's birthday party.
Photo: Peter King



Club Roundup

Coming Events

4 to 7 May
Hare & Forbes Parramatta: workshop machinery sale.

6, 7 May
Invitation run - Mackay Qld
Just four hours south of Townsville. Join them on the May Day weekend. All convention travellers are welcome to drop in for a run any time. Contact: Col Etwell (079) 52 2401 or Len Heaton (079) 59 2169

20, 21 May
Annual engine rally - Gisborne Vic
Gisborne District Steam and Engine Society Inc. Annual engine rally at Gisborne Steam Park.

21 May
Annual boating regatta - Galston
The Hornsby & District Model Engineers invite all model mariners to Fagan Park for a fun day on the pond. Contact Alan Fern (02) 639 8173 for details.

27 May
AALS Interclub run - Galston
The Hornsby & District Model Engineers invite all Model Engineers to their Galston Valley Railway, Mid Dural Rd Galston NSW. Contact the Hon Secretary (02) 872 5173 for further information.

3,4 and 5 June
Open weekend - Manukau NZ
Manukau Live Steamers open weekend.

10 to 12 June
Winter run in Wollongong
Illawarra Live Steamers, Stuart Park, Virginia St, North Wollongong.

26 August
AALS Interclub run - West Ryde
The Sydney Society of Live Steamers invites all clubs to their track from 8am to 10pm. Contact the Secretary for details: PO Box 124, West Ryde, 2114.

21, 22 October
7th Australian Traction Engine Rally
The Inverell Pioneer Village, NSW, is the venue for this year's national miniature traction engine rally. Contact: Bob White (067) 22 1569 or Gordon Blake, (067) 22 4272.

5 to 10 January 1996
Steam Expo 96 - New Zealand
Otago Model Engineering Society. Contact the Convener, PO Box 2163 Dunedin 9030 New Zealand

Castledare WA

Wednesday running during the school holidays in January proceeded as usual but with patronage down, probably due to the very hot weather this year.

Western Power has sponsored the supply of coal fuel for a period of 5 years.

An evening BBQ followed by night running was held on 11 March.

Two small privately owned diesel locos have been purchased by John Smith from former member Cliff Hickling. Club stalwart, Jack Stanbridge, recently celebrated his 80th birthday.

A club program has been instigated for the manufacture and repair of rolling stock bogies. The club now deems it necessary to begin a bogie standardization program.

Castledare Miniature Railways of WA Inc.

Contact: Secretary, PO Box 337, Bentley, WA, 6102.

Location: Rear of 100 Fern Rd, Wilson Perth WA.

Mangere Auckland NZ

Loco building continues. Dave Watt and Murray Lane displayed progress of their current projects, at the January '95 social evening.

An impromptu running day was held on 6th February, with visitors from Thames, Napier, Whangarei and Hamilton, as well as local members. 18 locomotives were present, with 15 on the track during the day.

Two members travelled to the new track 10 kilometres north of Taumarunui at Manu-Ariki Marae for the opening meet 10 to 14 January 1995. This is New Zealand's longest track, at 3 kilometres in length, and some say the best 7¼" railway in the world. 16 locomotives were present from all over the north island. This track climbs to a height of 52 feet in 1.25 kilometres, with a 1 in 70 grade up to the summit, reached by two steel viaducts, two tunnels and a spiral. The track then descends for 800 metres to rejoin the original track. The run takes about 25 minutes. Construction of this track only began in October 1994 and in a short time, several thousand cubic metres of earth were moved to provide suitable contours for the track bed. The track, structures and facilities were all in position ready for use by early January. This effort must be a record considering the work undertaken.

Two members also travelled to the Rotorua open weekend.

Manukau Live Steamers Inc.

Contact: Secretary PO Box 43-095 Mangere Town Centre Auckland New Zealand.

Location: Mangere Centre Park, Robertson Rd, Mangere, Auckland.

Public running day: Every Sunday.

Wagga Wagga NSW

Members have been quite busy in recent times with various areas of activity. The new display building is nearing completion after months of work. Work also continues on the grounds under the capable supervision of David Frost and helpers. Months of hot, dry weather have made their task more difficult with constant water required. Work continues on the traction engine track with completion scheduled for later this year.

New locomotives to enter service are a 7¼" Willis *La Quinta* 2-6-0 owned by Roydon and Rosemary Burk, and on New Years day 1995, the new club loco, a 7¼" Lil Lima 2-4-0, built by Ray Catts, made its debut. Other locos shortly to make their maiden runs at Wagga Wagga include the 7¼" Royal Scott 4-6-0 of Ivan Evans, the 7¼" 0-6-0 petrol/mechanical from the Cec Applebee Shops and the Tri-bo petrol/mechanical built by Roydon Burk. Quite a few others are in advanced stages of construction. Clive Huggan has his 7¼" 500 Class 4-8-2 in the shops for heavy overhaul. David Frost's 7¼" Shay has also entered service. The annual Australia Day run saw large crowds in attendance for a free ride, the Society's way of thanking the public for their patronage during the past year.

Planning is now in hand for the annual Invitation Run — 3 to 6 November 1995.

Wagga Wagga Society of Model Engineers Inc.

Contact: Secretary, PO Box 119 Mt. Austin 2650.

Location: Botanical Gardens, Wagga Wagga (Willans Hill).

Public running days: First and third Sunday of each month.

Tullamarine Vic

The inaugural run of the new 7¼" gauge club locomotive *Jonesy* took place on Saturday 11 February 1995 among much excitement by members and guests.

Mrs Lloyd Jones unveiled a commemorative plaque to mark the event.

Resplendent in sky blue livery, the poignant first lap of one mile, under the control of driver Murray Mitchell, was savoured by the family of the late Lloyd Jones, and witnessed approvingly by 300 visitors and members of AALS. The club hosted 24 visiting locomotives under ideal weather conditions, with top notch catering, barbecue and beverages in a splendid picnic area beneath the trees or in the clubhouse.

Tullamarine club would like to invite all to trackside activities and steam-ups.

Tullamarine Live Steam Society

Contact: Secretary, Wayne Roberts, PO Box 107, Tullamarine Vic. 3043.

Location: Springbank St, Tullamarine.

Public running day: First and third Sunday of of each month.

Fairfield NSW

Work has been in progress, with the help of a concreter, to finish off the concrete pad around the steaming bay turntable hoist, and the concrete foundation for the ground level curve at the bottom of the track approaching the station. Members have also been busy with a general clean up of the grounds.

Western Districts Live Steamers Co-op Ltd

Contact: Secretary, PO Box 224, Cabramatta, 2166 NSW.

Location: Fairfield Show Ground.

Public running day: Third Sunday of each month.

New Plymouth NZ

January was quite hectic for those members who travelled to the opening of the new Manu Ariki Marae track in Taumaranui 10th - 14th January 1995, and the open weekend at Rotorua. The new track at Taumaranui consists of 3 kilometres of 7¼" gauge, and has the potential to be one of the most beautiful tracks in the world.

New Plymouth Society of Model and Experimental Engineers Inc.

Contact: Secretary/Treasurer
Phone: 753 4528.

Location: Cnr Liardet and Gilbert Sts, New Plymouth New Zealand.

Running day: Sunday after the Tuesday meeting.

Eltham Vic

A rousing good Christmas party was held in the new clubhouse, as the climax to the 1994 running year. The 1995 year began well, with very heavy passenger traffic in January along with extra running on school holidays, Wednesdays and public holidays. Brian Coleman has been appointed as public relations officer, his activities contributing to increased patronage. Future public relations articles are proposed for Royal Auto, Australian Post and Women's Weekly magazines. The club is presently attempting to determine when the two millionth passenger will be carried. A 30 hour railathon was held on the weekend of 11 and 12 March 1995. Also over this weekend, DVR had a promotional stand at the Camberwell AMRA Exhibition. Work continues with alterations to and updating of the signalling system, and the continual maintenance of locomotives and rolling stock. Each club loco has its own "custodian" member to oversee maintenance and repairs. A total of 37 7¼" gauge locos are currently used for club activities: a mixture of steam, petrol electric, battery electric, petrol mechanical and diesel hydraulic.

A concerted effort is being made on maintenance programmes involving club grounds. Structures work to be shortly undertaken includes the replacement of Meadmore Junction signal box and painting of carriage and workshop buildings. Other new projects include a new footbridge, a rail bridge, miniature lake and waterfall with accompanying landscaping, together with a new goods platform and goods shed at lower Nillumbik for maintenance and construction equipment. Plans are also in hand for additional trackwork.

Diamond Valley Railway Inc.

Contact: Secretary PO Box 245, Eltham Vic. 3095.

Location: Eltham Lower Park, Eltham, Melbourne.

Public running day: Every Sunday.

West Ryde NSW

The new ground-level track footbridge has now been erected, its construction being of galvanized steel on concrete footings. It is a very professional and substantially built structure.

Work also continues on the elevated track lever frame. On 11 March, Ray Lee organized a visit to Eveleigh, to inspect the progress on the ex NSWGR loco 3830.

The Society is host to the NSW AALS inter-club run on 26 August. Everyone is welcome!

Sydney Live Steam Locomotive Society

Location: Anthony Road, West Ryde, NSW.

Public running days: Third Sunday of each month.

Geelong Vic

A new club has been formed in Geelong, the sole interest being locomotives.

The club, known as Geelong Live Steam Association, is the recipient of the track of the late Sir Ronald East. The track will be reassembled, and a plaque affixed commemorating Sir Ronald East and the donation of the track by the East family.

The track is above ground multi-gauge 2½", 3½" and 5".

Presently, the club is looking for suitable land on which to lay a ground level 5" and 7¼" gauge track in the near future.

Membership to the association is by invitation only. Further information is available from the Secretary, Tony Anderson, 38 Hazelwood Cres, Leopold. Vic 3224. Telephone (052) 50 2332.

Geelong Live Steam Association

Location: to be advised.

Lake Macquarie NSW

Work continues around the club with the construction of new and stronger servicing roads for the 7¼" steaming bays, fencing extensions and alterations for safety and crowd control purposes, and the laying of new and improved dual 5/7¼" track near where the two gauges diverge to the hill and 7¼" station respectively.

Frank Ford had his new 7¼" 4-8-2 loco *Iron Lady* in operation for its maiden run just prior to Christmas. It was the first loco to use the new 7¼" track extension. The society's loco *Marjorie*, at the Richmond Vale Railway Museum, is almost ready to re-enter service, after undergoing mechanical repair and renewal of five firetubes. The loco may also be repainted.

Lake Macquarie Live Steam Locomotive Co-op Society Ltd.

Location: Off Velinda St, Edgeworth (Newcastle).

Public running day: Last Sunday of each month.

Wanganui NZ

1994 activities concluded with a BBQ evening in December. 1995 commenced with the open anniversary weekend — a great success with eight visiting locomotives and happy participants. Work on the extension to the club rooms, to accommodate the railway modellers' layouts, has reached the lock-up stage, with interior work in hand.

The Wanganui Model Railway and Engineering Society Inc.

Location: 70A Alma Rd, Wanganui.

Public run day: Last Sunday of each month.

Panmure Auckland NZ

The club hosted an open weekend over Easter, together with an exhibition displaying a history of early locomotives. Members are keeping themselves busy with various modelling activities, the results of which are regularly displayed at meetings; the highlights usually being the large parts for the latest loco under construction by Murray Lane.

Jack Nears and his wife recently spent 10 days in Tasmania, and were most impressed with the operations of the 15 inch gauge Bush Mill Railway at Port Arthur.

The Auckland Society of Model Engineers Inc.

Contact: Secretary PO Box 14570 Panmure Auckland New Zealand.

Public running days: Every Sunday.

Gisborne Vic

Extensive landscaping is underway at the Steam Park in preparation for the steam rally 20, 21 May 1995.

The May rally is to be improved this year with more entertainment for children, an army vehicle display, and a white elephant stall. The society is presently constructing a station building for the 7¼" railway. Future plans for the railway include track extensions together with a tunnel and trestle bridge.

Restoration of the Society's 2 foot gauge Perry 0-4-2 steam loco to running order was completed last year. This loco operates on the 2 foot gauge trackwork at the steam park. A 2

foot gauge passenger carriage is to be constructed in the near future.

The Gisborne District Steam and Engine Society Inc.

Contact: Secretary, PO Box 99, Gisborne, Vic. 3437.

Location: Gisborne Steam Park, Webb Cres, New Gisborne, Vic.

Public running day: First Sunday of each month Sept. to May.

Nelson NZ

Public running was provided daily from 26 December 1994 until 7 January 1995 as weather permitted, and a night run was held on 18th February.

Some members attended the Blenheim run day on 12th February At the general meeting held on 14th February, Bruce Bertram gave a talk about his railway experiences in North America and Europe.

Nelson Society of Modellers Inc.

Contact: Secretary, PO Box 810 Nelson, New Zealand.

Moorabbin Vic

The Society is considering the introduction of a club uniform to improve the public image of members.

New locomotives continue to appear, though not as quickly as the builders wish!

Max Kuhn's and Alan Jones's *Springbok* locomotives have both entered service. Both builders co-operated during the construction of their locos — a good example to all builders.

The GWR tank loco from the shops of Colin Stanton has also entered service, together with a steam tram owned by Keith Hartley.

10 to 13 March saw the small gauge revival for gauges 1¼", 1¾",2½", 3½" and 5" held by the Society.

The Steam Locomotive Society of Victoria Inc.

Contact: Secretary PO Box 115, Moorabbin, 3189 Vic.

Location: Rowans Road, Moorabbin, Melbourne Vic.

Public running day: 1st Sunday of the month, except January.

San Francisco USA

New Years Day 1995 saw 50 members and four or five locomotives on the track for the Chilli Run.

Due to wet and foggy weather, most activity occurred indoors. 82 year old Ralph McChesney, a member since 1938, was honoured at a January dinner, for his 50th wedding anniversary. At the February meeting, a silent auction of Dwight Durkee's collection of railroad books was held, all bids being in writing.

On Saturday 12 August, the third annual small gauge meet will be held, for 2½" and 3½" gauge models. Members have a busy schedule for the year, revolving around activities at the Tilden Park Track, and meets in Florida, Vancouver Island, Sacramento and Los Angeles Live steamers tracks.

Golden Gate Live Steamers Inc.

Contact: The Secretary, Jim Dameron 130 Pereira Ave, Tracy, California, 95376, USA.

Location: Tilden Park, Cnr Grizzly Peak Blvd and Lomas Cantadas, Berkeley.

Public running day: Every Sunday, weather permitting.

Club Roundup contributions

AME is pleased to receive club newsletters for consideration in this section. Newsletters are often a good source of articles, which we appreciate all the more, but most of all they help us keep in touch.

It is often difficult to decide what to publish and what to leave out. and the task of selecting material for a wider audience takes a lot of time. Also, there is always the risk that AME will publish something that the club considers sensitive. Please help by sending a "press release" page with your newsletter, or highlight the items you think we could use. We'll give first preference to clubs that help us out this way.

bmc

A 5" gauge NSWGR 422 class Diesel Outline Locomotive

Part 20 of the construction of a battery electric locomotive

Neville Levin discusses the auxiliary electrics and some optional improvements which can enhance the electrical system

Drawings for publication by Neville Levin. Photos by Neil Graham

This issue we will look at the auxiliary electrics and will get the bulk of the rehardware installed and complete the wiring of same. Also, although it was mentioned in the Jan-Feb 1994 issue of the magazine that the main electrics had concluded, several suggestions have been received from both readers and those involved with the 422 project. I have taken these suggestions on board in the belief that they will enhance the final product. They are optional facilities and are briefly described below. You may wish to incorporate none, some or all in your locomotive.

However, because we believe that the majority of owners will install these prototypical facilities in their locomotives, it is proposed the new facilities together with the updates and corrections published on page 42 and 47 Jan-Feb 1994 be part of a re-issue of the drawings referred to as Version 2. Where possible components shown in the original drawings i.e. Version 1 will retain the same code in Version 2. This means that the Version 2 parts list will generally apply for constructors who retain their locomotives, unmodified. Figures affected by the Version 2 update and an amended parts list are included in this issue.

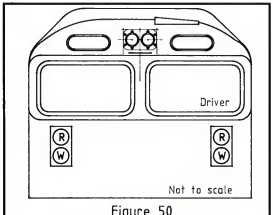


Figure 50
MARKER LAMP ORIENTATION

Drawings

Copies of the complete set of circuit drawings plus parts list (including Version 2 update) and new, additional sheets for permanent-magnet motors for the 422 class battery powered locomotive are available from AME Retail, PO Box 355, Kooringal NSW 2650. Unless stated otherwise, the following update description refers to Version 1 drawings. These have previously been published in the AME issues No.49, July-Aug 1993; No.50, Sept-Oct 1993 and No.51 Nov-Dec 1993. Corrections are in the No.52, Jan-Feb 1994 issue.

Marker lights orientation

Now before we go any further, for some reason in the last issue, the orientation of the marker lights was not mentioned in the description. Now that may be okay for those in NSW, but for those of us south of the border, we need to know more. So for those who need to know, Figure 50 shows the layout viz: red to the top and white lower.

M-U update

In the original text the multiple unit (m.u.) facility using a simple low cost interface allows for reliable operation of two locomotives to operate in m.u.

A more expensive and complex low power m.u. interface circuit had been developed to enable up to ten locomotives to satisfactorily m.u. using the data interface cable as specified, but because of the cost factor, I settled for installing the simple arrangement believing that two locomotives would handle the majority of public running operations.

Since this is purely an option, constructors or operators wishing for drawings on the low power m.u. interface should write to AME Retail at the above address.

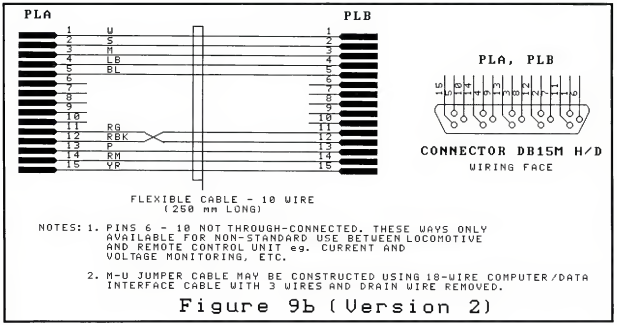


Figure 9b (Version 2)

Horn operation

When several Version 1 locomotives are used in m.u. and the horn button is pressed, all units sound-off. on the full size, the leading locomotive normally is the locomotive with the operational horn (usually the only one with a crew?). So what we need is a facility to mute the horns of the loco-

motives in the shafts (in m.u.).

The solution is to mount a single pole single throw (SPST) toggle switch (horn master switch) on the Central Accessory Panel "A" of the locomotive. Connect the two tags of the horn master switch in series with the wire between the CCS terminal strip/terminal 5 and the junction of the horn relay coil and its suppression diode (D1). When the horn master switch is on, the horn is enabled. Switch it off and the horn is disabled. When coupling up the locomotives prior to m.u. operations, the crew should set the switch to off in all except the lead locomotive.

N.B. I suggest you make this change after the head lights have been fitted and the wiring completed as the spst lights on/off switch will become spare during this update and may be used to provide the new facility.

M-U direction control

Experience in operations with this project got me wondering "How do the prototype locomotives changeover direction controls when preparing for back-to-back running in m.u.?"

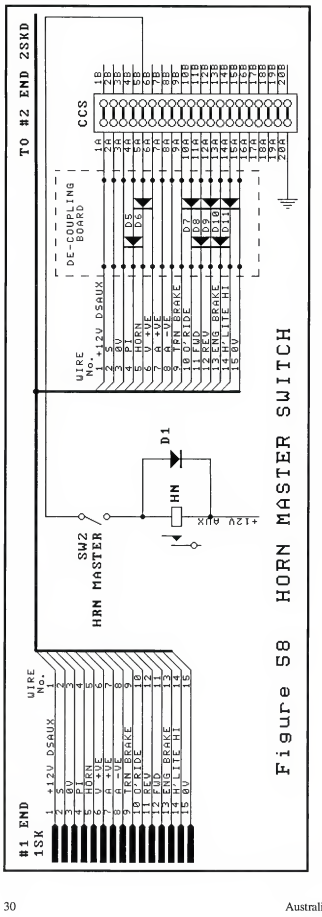
The answer I got was "The locomotives have the forward and reverse wires transposed in the No.1 end m.u. socket, and, also in each interconnecting jumper cable!"

This simple solution means that the responsibility of operating the equivalent of the end reverse switch is removed from any person and it also minimizes equipment, improves reliability and provides for faster assembly of units in the loco depot. For those readers operating m.u.'s and who wish to provide this facility, the changes to the 422 Version 1 are as follows:

- Set the "end reverse switch" to run the loco forward when the controller is plugged into the No.2 end and forward is selected on the controller direction switch.
- Referring to Figure 9b, on one plug of the interconnecting jumper cable remove the shell and reverse the wires connected to pins 11 and 12. Check and make sure there are no bridging strands of wires. Replace the shell and paint a 5-10mm wide red band around the cable on the modified end to remind you that it has the direction wires reversed on that plug.
- In the locomotive, on the lower pins of the De-coupling board, reverse wires 11 and 12 coming from the No.1 end only m.u. connector (1SK). Make sure you only reverse the wires from 1SK (not 2SK). The reversal only affects the No.1 end! Check the six points with your ohmmeter to make sure 1SK/11 terminates on decoupling board pin 12 and 2SK/12. Also check that 1SK/12 is connected to decoupling board pin 11 and 2SK/11.

This modification now makes the end reverse switch, cradle relay and its wiring redundant. The relay may be removed but leave the switch as this will be used for the marker master switch (to be described later).

- To complete the change, the wires from CCS/11 and CCS/12 must be re-run direct to the forward and reverse relays' coils, respectively. Check to see if the free ends of wires on CCS/11 and CCS/12 (removed from the ER relay) can be rerouted to reach the tags on the forward and reverse relays. If not, run a new signal wire between CCS/11 and relays 1F/85, 2F/85. Run a second wire between CCS/12 and relays 1R/85 and 2R/85. Sleeve and insulate the two wires in the loom that connected the ER coil to the ER switch on the central Accessory Panel "A".
- Check the console operation. Plug the driver's console into the No.2 end m.u. connector (2SK) and select forward on the direction switch. Open the throttle and the loco should move with No.1 end leading. Check for reverse running when reverse is selected. Now transfer Console plug to No.1 end m.u. connector. Repeat the test. This time No.2 end should lead when forward selected and No.1 end lead when reverse selected. If reversed, check the 1,2F and 1,2F direction relays' coil wiring to the No.1 and No.2 end m.u. connectors and ensure that the circuit is in accordance with the drawing. If okay, check that the console plug PLA/11 is connected to the forward side of the direction switch and PLA/12 to the reverse side, incorrect wiring between direction relays and m.u. connectors may be embarrassing.
- If you have fitted the OR relays and carried out the coil wiring as per wiring diagram (Figure 7, Version 1) a modification should be made to the wiring to improve the fail-safe characteristics of the control system! The preferred connection is correctly shown on the schematic diagram (Fig.3, Version 1, as previously printed) wherein the OR relays' coil voltage is supplied from the +12V SAUX line. Remove the +12V AUX wire coming from 1SKD/1, from pin 85 on the Hella relay 2OR and re-terminate it on TBK/85. To extend +12V SAUX to the OR relays, run



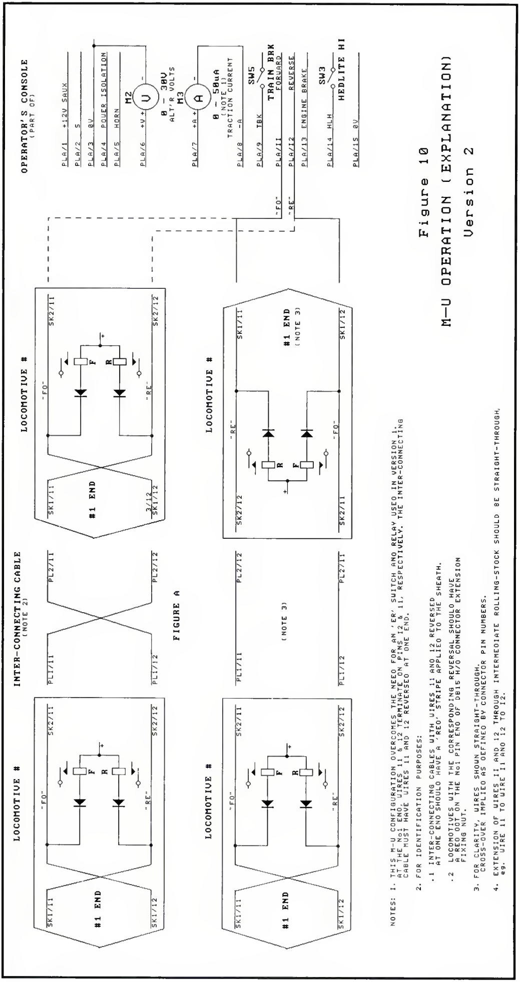


Figure 10
M-U OPERATION (EXPLANATION)
Version 2

a new wire between 2R/86 to 20R/85. Amend the wiring diagram.

Metering

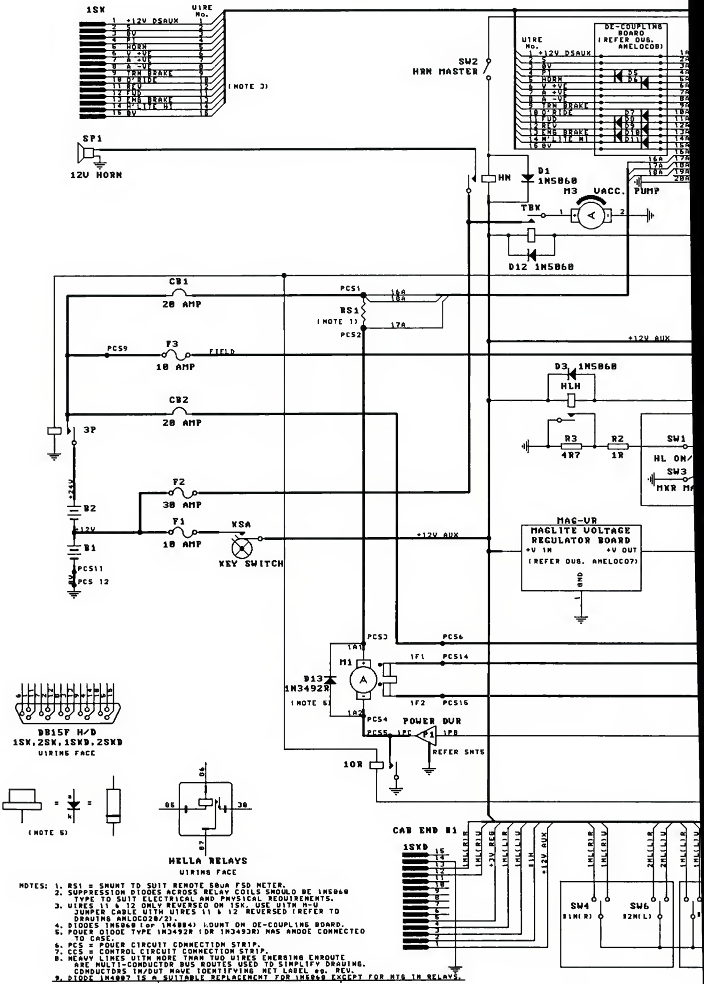
Several constructors have had a problem with the driver's console Voltmeter/Ammeter indications. Subsequent investigation has showed a possible metering error can occur if low impedance voltmeters are used in conjunction with the common circuit feeding the series protection resistor RL1 (47 ohms) and the ammeter via CCS pin 6. The following solution is offered to minimize the problem. The preferred wiring is described below. Refer to Figure 3b, which supersedes previously published Figures 3 and 3a.

- Remove the wire strap between CCS/6b and CCS/7b,
- Remove RL1 and terminate one end on CCS/16b and extend the other end and terminate on CCS/8b,
- Remove RL2 and terminate one end on CCS/17b and extend the other end and terminate on CCS/8b,
- Terminate a new resistor RL3 (47 ohm) between CCS/18b and CCS/7b and,
- Wire PCS/1 to CCS/16a, PCS/1 to CCS/18a and PCS/2 to CCS/17a using light duty PVC insulated cable, i.e. 7/0.26mm (2.5amp) or space wire stripped from the m.u. cable.

Note that the 47 ohm resistors provide short term current limiting in case of an earth fault on wiring associated with CCS pins 6,7 or 8. RL2 will not protect the Ammeter.

Headlight wiring

So that we can operate the 3 volt head light lamps from the +12V AUX battery supply, we need to have a voltage device which is adjustable. To attain this a voltage regulator is required to reduce the +12 volts from the No.1 battery to just under 3V for the supply to the MINI MAGLITE AAA headlight lamps. One regulator is required per locomotive and a schematic circuit of the unit is shown in Figure 55 and a parts list is also shown. The parts should be readily available and cost about A$15 (includes matrix board). The revised schematic and (Figure 3b) shows the input to the regulator connected to the +12V AUX supply in the locomotive chassis and the return side connected to 0V. The output is fed to the headlight lamps via



NOTES:
1. RS1 = SHUNT TO SUIT REMOTE 50uA FSD METER.
2. SUPPRESSION DIODES ACROSS RELAY COILS SHOULD BE 1N5060 TYPE TO SUIT ELECTRICAL AND PHYSICAL REQUIREMENTS.
3. WIRES 11 & 12 ONLY REVERSED ON 1SK. USE WITH M-W JUMPER CABLE WITH WIRES 11 & 12 REVERSED (REFER TO DRAWING AMLOCO20/2).
4. DIODES 1N5060 (or 1N4004) MOUNT ON DE-COUPLING BOARD.
5. POWER DIODE TYPE 1N3492R (OR 1N3493R) HAS ANODE CONNECTED TO CASE.
6. PCS = POWER CIRCUIT CONNECTION STRIP.
7. CCS = CONTROL CIRCUIT CONNECTION STRIP.
8. HEAVY LINES WITH MORE THAN TWO WIRES EMERGING ENROUTE ARE MULTI-CONDUCTOR BUS ROUTES USED TO SIMPLIFY DRAWING. CONDUCTORS IN/OUT HAVE IDENTIFYING NET LABEL eg. REV.
9. DIODE 1N4007 IS A SUITABLE REPLACEMENT FOR 1N5060 EXCEPT FOR MTG IN RELAYS.

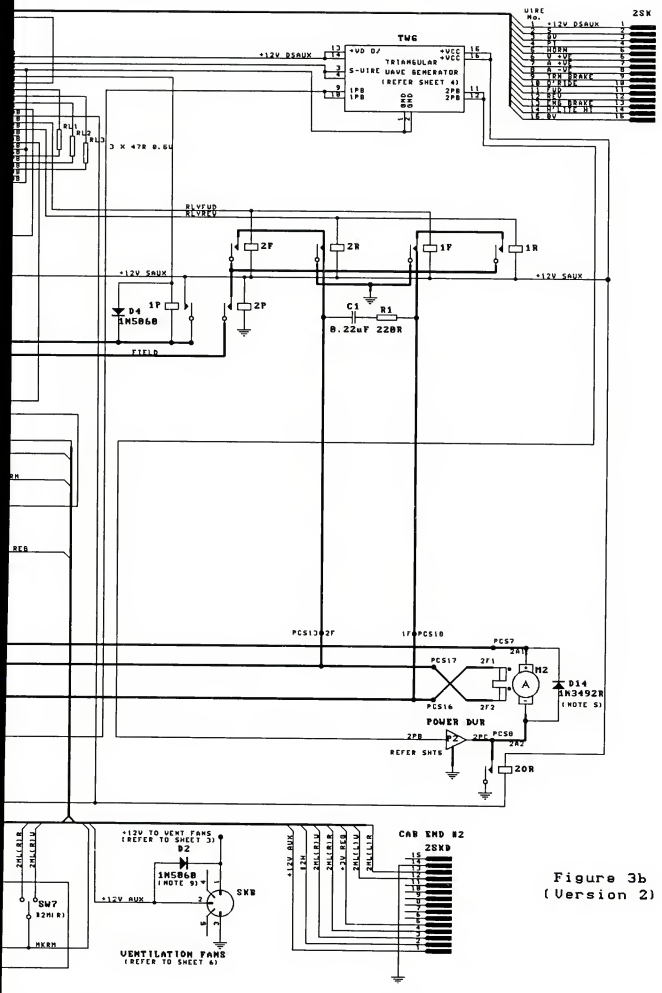


Figure 3b
(Version 2)

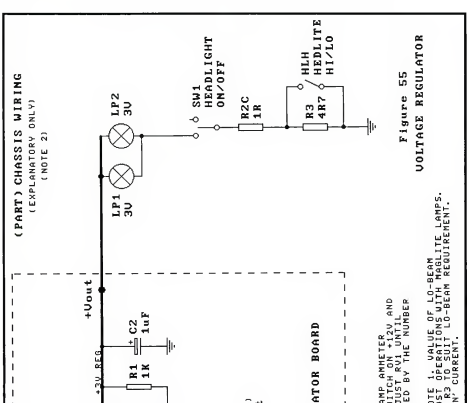


Figure 55
VOLTAGE REGULATOR

the HL on/off switch and cab mounted DB15 H/D connectors. More on this later.

Making the board

Produce a pattern by photocopying the full size board layout diagram (Figure 56). Trim the pattern to size by cutting around the border and tack glue it at the corners to the matrix board or old printed circuit board with all the copper track cleaned off. Then:

- Drill transistor (U1) mounting holes No.23.
- Drill transistor (U1) pin holes No.43.
- Where necessary, drill all other component mounting holes No.60.
- Using the "figure eight" symbols as guides, drill four component board mounting holes 3.3mm (No.30) dia. for four 6BA fixing screws. Nominal centre distance on 0.1" module is 3" x 1.9" (75 x 48).

Where required, drill through the pattern to produce the board and component mounting holes. Four matrix board pins, screw inserts or a 4-way (minimum) male board mounted connector maybe used to extend the wiring from the regulator to the cabs and other points in the locomotive circuit. As the voltage regulator unit should be reliable and not require frequent removal the matrix board pins are the cheapest solution.

Assembly

Mount the components over the overlay pattern making sure that the diodes and tantalum capacitors are correctly inserted in the circuit board according to it's polarization marking (white band, +, respectively). In this application it is un-necessary for the TO-3 case of the LM317K voltage regulator to be insulated from the heatsink. Just remember not to hit the heatsink and chassis with a wire or metal object when the power is on. Smear the base of the TO-3 case with heatsink grease and insert the transistor pins through the heatsink. Fix transistor and heatsink in position on the board using the 4BA screws, lockwashers and nuts (in a similar fashion to that used on the power unit heat sinks. Refer AME magazine page 37 Sept-Oct 1993). Bend the leads down on those components with axial leads and at the appropriate spot on the pattern feed them through the holes in the board. Bend over to retain the component in position and nip off with the cutters ready for terminating on the bus. When all components are in place carefully check to ensure that each is in its correct position and correctly polarized.

Obtain several 300mm lengths of about 0.5mm^2 (20 swg) copper wire extracted from PVC insulated power cable and your roll of flux activated solder. Clamp the end of the wire in a vice and using pliers stretch with enough force to permanently straighten the wire. On the track side of the circuit board (opposite to component side), solder lengths of the copper wire between the components in accordance with the pattern. Remember, the pattern shows the tracks by looking through the board from the component side to the wiring side.

N.B. Take extra care not to overheat components. Also re-check the tracks to make sure they go to their correct destinations.

Final check

When the wiring is complete. Do a very careful check to make sure the tracks terminate on the correct components. When your satisfied they do, remove the paper overlay from the component side of the board making sure that you get it all especially under the multi-turn trimpot resistor. If the paper remains and gets damp you could have intermittent problems later and they are usually hard to find.

Adjusting the output voltage

Check the operation and output voltage before installing. Clear the bench of scrap solder wire so that it doesn't bridge the tracks of the regulator. Set the multimeter to the 20V d.c. range and have a charged up 12V lead/acid battery near-by. If you haven't got your batteries for the loco yet, run two insulated jumper wires to the car battery. Make sure you mark each end of one wire positive and the other wire negative, respectively and connect to battery accordingly.

- Set the multimeter to the 20V d.c. range, and connect it to the +Vout and 0V terminals of the regulator.

Connect 0V on the regulator to the -Vout from the Battery supply. Check the connections.

- Connect a wire to the +Vin terminal on the voltage regulator and when ready, to +Vout from the Battery.

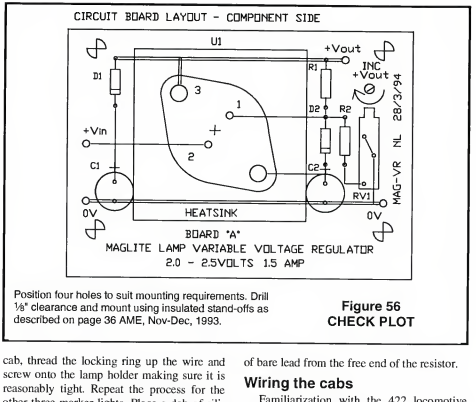
- Check the meter for a reading. If reading zero, immediately switch off the power and check the connections to the power source and meter. Any hot components? If okay, check the regulator circuit until you find the fault!
- Assuming all was well at first turn-on then note the reading on the meter. When connected into circuit this will become the lamp voltage and it should read 2.8 volts. Reducing the voltage below 3V will extend the life of the lamps while still giving plenty of light for night running.
- To adjust the output voltage, with an instrument screw-driver and watching the multimeter, rotate the screw on the multi-turn potentiometer about one turn to identify the direction required. Rotate the screw until the meter reads 2.8 volts.
- The final voltage setting should be made when the regulator is installed and wired into circuit with the operational head lamps set on Hi beam. This adjustment will take into account the 0.6V drop across the 1 ohm current limiting resistor (R2) and after making the final adjustment place small drop of red paint on the trimpot screw to lock it.

Mounting the regulator

Using the insulated stand-offs and 6BA x 25mm long fixing screws, lock-washers, washers and nuts, mount the voltage regulator on the No.1 end bulkhead well clear to the right hand side of the sound generator board drillings in a similar fashion to that described for the TWG (refer AME Nov-Dec 1993 page 36 and photograph on page 38, Sept-Oct 1993 to familiarize yourself with the information). Make sure that the trimpot screw is accessible. The wiring in of the voltage regulator will be dealt with when we describe the head light to chassis wiring.

Marker lamps — Mark 1

To make things easier during wiring, solder two 400mm long PVC insulated, wires onto the lamp Holder tags, one red (7/0.26mm core) and the other your favourite colour left over from the m.u. cabling exercise. Slip the lamp holder into the hole, wire first. Inside the cab, thread the locking ring up the wire and screw onto the lamp holder making sure it is reasonably tight. Repeat the process for the other three marker lights. Place a dob of silicon sealant on the ring and holder of each fitting to prevent it working loose with the vibration. Now check the marker light lamp caps. Looking at the cab front, each side should have red on top and white below. If incorrect lift and pull the cap from the holder with a thumb-nail or fine blade, (check to see that there is a lamp inserted) and replace with the correct coloured cap. A new tool for the toolbox! Obtain a piece of thin walled plastic tubing (spaghetti) that just pushes over the Lilliput lamp. When required to change a lamp, remove the cap, slip on the tubing and remove by pulling the tubing out. Replace lamp, slip on cap and your away! Repeat the process for the second cab.



Position four holes to suit mounting requirements. Drill ⅛" clearance and mount using insulated stand-offs as described on page 36 AME, Nov-Dec, 1993.

Figure 56
CHECK PLOT

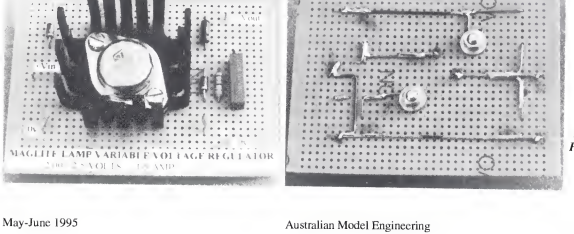
Marker lamps — Mark 2

Slide a piece of thin spaghetti over each of the legs from the LED. Cut the spaghetti so there is only about 3mm bare wire protruding from the spaghetti. On the short leg, solder a 560 ohm ½ watt resistor. Then slide a piece of heatshrink over the resistor and just soldered joint and cut it so that there is only 3mm of bare lead from the free end of the resistor.

Wiring the cabs

Familiarization with the 422 locomotive clearly indicated that dual sealed beam head lights and dual cab-switchable marker lights are used in the 422 prototype. The head lamp wiring is described in two parts, the cab and the chassis. So that you become familiar with the update, the cab wiring being the simplest part is described first.

The schematic diagram (Figure 3b) and cab circuit diagram (Figure 51b) show the updated wiring. The cab connectors (1,2PLD, 1,2SKD) provide the quick disconnect between cab and chassis wiring. The 5-pin DIN connector (as originally specified is replaced by the larger capacity DB15 H/D 15 way connector. This size was chosen because it was already used at each end of the the m.u. cable and carrying spare shells or male and female connectors reduced inventory even if a little dearer than others available on the market. It also provided spare pins for any additional cab circuits you may require in the future. Table 1 shows the extra parts required for these changes. I recommend at least an 8-way miniature screw terminal strip (TS) be used to inter-connect the cab fixed wiring and the flexible lead to PLD. The TS strip may be fixed low down on the left side of the cab by two countersunk screws, nuts washers,etc. It should make for easier installation and maintenance. If you think



Two views of the completed MAGLITE voltage regulator
Far left: *The component side.*
Left: *The wire side.*

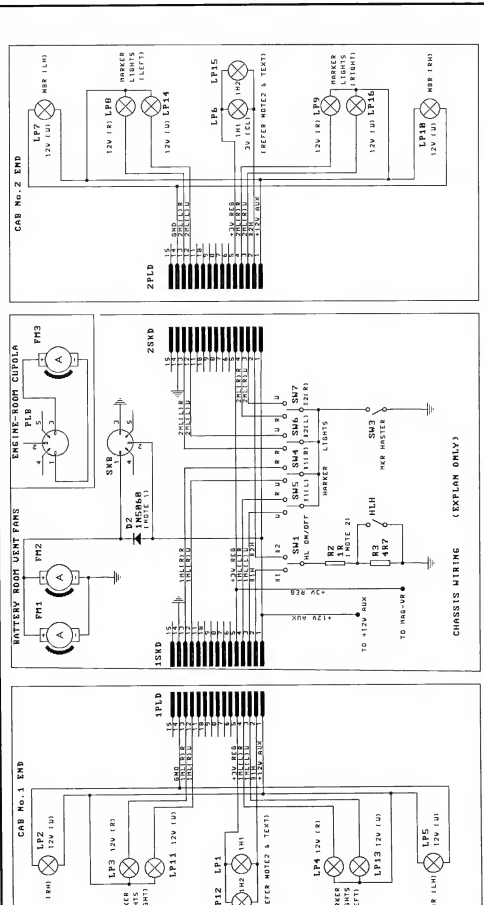


FIGURE 51b
(Version 2)

more external wires will be required later then fit a second 8-way strip. Number the terminals on TS the same as the 15-way connector (PLD), initially dropping out terminals 6-11 (or include them if they are accommodated on a 16-way strip). TS is not shown on the drawing or parts list as it is optional.

Except for the Number lights, all wires necessary for accessing the marker lights and head lights are in the cab so terminate them on the No.1 TS. Use the same terminal number on TS as the allotted pin number on PLD). Commence with the red wires (positive Battery) on terminal 1 (No.1 TS/1).

When all the circuits are connected to the terminal strip (as per Fig.11) cut two lengths of the m.u. data interface cable long enough to run between 1PLD (2PLD) and TS. Terminate fifteen wires from one end of the cable on a DB15M (male) H/D connector using the same colour-code was used when making up the m.u. cables. Don't forget to slip a 10mm length of 1.5mm heat-shrink sleeve on the wires before terminating on the DB15 connector. Terminate the other end on the cab terminal strip in accordance with the cab wiring. With your buzzer or ohmmeter check the wiring between each pin on connector 1PLD and its relevant lamp tag(s) for continuity.

This completes the wiring for the first cab except that the countersunk holes need filling and smoothing off as described in the Mar-Apr 1994 issue of AME magazine. Repeat the process for cab No.2.

Wiring the chassis

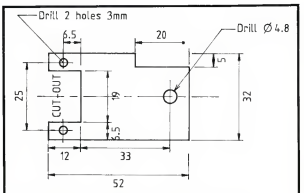
Mechanical

Where small components such as resistors or diodes appear in the circuit eg. R2 and R3, arrange these to terminate between fixed terminals such as on a securely mounted piece of matrix board. Remember to sleeve all the terminations on DB type connectors with heat-shrink spaghetti.

Prior to commencing the wiring of the chassis make two new mounting brackets in accordance with Figure 53. Alternatively, you may wish to modify and re-use the old redundant m.u. brackets as per Figure 15 (AME issue 50, Sept-Oct 1993, page 34. Simply bend the bracket into a u-shape, and mount it in the cab floor drillings previously allocated to the m.u.

Then drill five additional 6.5 diameter holes in Accessory Panel "A" as per Figure 23b, four for marker light switches and one for the horn master switch. Make sure you protect the wiring, etc. from metal swarf when drilling panel "A". Remove sharp edges from holes with a twist drill. The throw of the switch levers is to be vertical. To lock the switch in position, slip the keyed polarizing washer onto the switch body and using it as a gauge, hold the switch vertical and mark the position of the washer polarizing pin on the panel. Drill a No.50 hole in the panel. Repeat for the other three switch positions. This will prevent the switches drifting from the vertical when tightening the fixing nut or during running. Fit the four 3-position centre-off miniature toggle switches in the panel. Label the back of the panel with the switch code eg. SW5 or, No.1(L) meaning No.1 end left, etc.

On panel "A" remove both wires from the lights on/off switch. Join the two bared wires, solder and insulate. On new wiring connect 0V onto pin 30 of the HLH relay (Figs.9 and 17). Remove the wire between the ER relay and resistor R2 (1R = 1 ohm). Replace the lights on/off switch with a 3-position centre-OFF miniature toggle switch (HL on/off) and position it so that the lever moves in the horizontal plane i.e. towards No.1 end and towards No.2 end. Repeat the marker light switch polarizing process described above to hold HL on/off switch horizontal in the panel. Label the back of the panel with the switch code SW1. The new HL on/off switches on (or off) the No.1 or No.2 head light depending whether the lever is thrown towards the No.1 End or No.2 End, respectively. The recovered spst lights on/off switch may now positioned vertical and fixed in the hole for the horn master switch, ready for wiring.



Head lamps

Care and concentration will be required here because the wiring involves a mechanical and wiring change. Again I suggest you mark off on the circuit, each wire as it is run and terminated. Remove the No.1 end DIN Socket (1SKD) and its mounting bracket from the relay strip. Replace the mounting bracket with one made as per Fig.53, for a DB15 H/D connector. Don't attach the connector to the bracket until the eight wires have been terminated. To steady the connector during terminating, support in a toolmaker's vice or clamp.

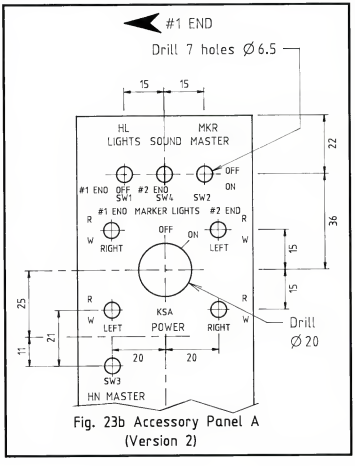


Fig. 23b Accessory Panel A (Version 2)

Transfer wires from the DIN Socket SKD/1 and SKD/3 to the replacement DB15F connector as follows:

- From Pin 1 (DIN) to Pin 1 (DB15) (+12V AUX),
- From Pin 2 sleeve and insulate,
- From Pin 3 to Pin 14 (0V or GND),
- From Pin 4 sleeve and insulate.

Repeat the above procedure for No.2 end (2SKD). Both ends should now have a DB15F H/D connector and two chassis to cab wires terminated on pins 1 and 14. Run two 1 amp (say 7/0.2mm from computer cable) PVC insulated single core automotive cable from the +V Out post on the regulator board to cab No.1 and cab No.2. Terminate on 1SKD/5 and 2SKD/5, respectively.

Terminate five 7/0.2mm (m.u. data cable) wires on 1SKD/2, 3, 4, 12 and 13 and run the free ends along the loom to SW1, 4, 5, 6, 7 on the accessory panel "A". Terminate the free end on the No.1 end switch tags. Note that marker light switches have the W-tag on top and R-tag below and this corresponds to the lever position down and up, respectively. The tag position is the reverse of the lever position and lamp colour.

Terminate the head light wire from 1SKD/2 on SW1 tag furthermost from No.1 end and vice versa for the wire from 2SKD/2. Run a 7/0.2mm auto. wire from the centre tag of the headlight on/off switch to R2.

Voltage regulator power connection

Before you can test the switching and lamps under power the voltage regulator wiring has to be completed. Pick up the +12V AUX loop (ends) that was left in the cab on its run from the key switch to the cab cable connector 1SKD and 2SKD and terminate on the +Vin post on the regulator board. Run a 7/0.32mm PVC insulated single core automotive cable between 0V regulator post and a suitable 0V bus point in the cab.

Testing lamp circuits

With the power switched on and marker master on, operate the HL on/off switch and each marker light switch in turn and check that each relevant lamp lights at the designated end. If faulty trace the wiring until the fault is found and correct it. With all white markers on, operate marker master off and on. All selected marker lamps should extinguish or glow depending on marker master switch position. Check that head light remains unaf-

Electrical and Electronics Parts List - (Includes Version 2)

CAB LIGHTING and CHASSIS WIRING

Item	Qty	Ref.	Description	Cat.No.
1	1	SW1	**Headlights,** Mini switch,SPDT, 3-pos., centre off	S6070
2	4	SW4 to SW7	**Marker lights** Mini switch, SPDT,3-position,centre off.	S6070
2f	1	SW3	**Marker lights, Master switch** Mini switch, SPST (Use recovered end reverse switch from Vers.1)	S6056
3			**Cable Connectors**	
3a	2	1PLD & 2PLD	Cab cable connectors, male 15-pin high density, D-connectors, DB15P	P1516
3b	2		Backshell with screws, DB9	P1909
3c	2	1SKD & 2SKD	Cab cable connector, female 15-pin high density, D-Connector, DB15S	P1616
3d	2prs	1SKD & 2SKD	Screwlock assembly	P2150
4			Lengths heatshrink sleeving various sizes.	
5	1	SW2	**Horn,** Master switch; Mini switch, SPST (Can use recovered hedlite on/off switch from Vers.1)	S6056
6	1	R2	1.0 ohm, 0.5W, resistor	R3010
7	1	R3	3.3 ohm, 0.5W, resistor (R3 may be recovered PW5 from Vers.1)	R3033

NOTES:

1. The catalogue numbers apply to the mail order price list from The Electronics Components Shop, 289 LaTrobe Street,Melbourne VIC, 3000). Enquiries and local telephone calls 03-602-3499, mail order hot line 008-335-901.
2. Direct equivalents of the items described above should be available from other reputable electronic component stores, e.g. Jaycar Electronics.

HEADLIGHT VOLTAGE REGULATOR

Item	Qty	Ref.	Description	Cat. No.
1	1	RV1	1K Trimpot, multi-turn	R-1900
2	1	R2	Resistor, 68R, 0.5W.	R-1246
3	1	R1	Resistor, 1K 0.5W.	R-1274
4	2	C1, C2	Capacitor, 1uF 35V tantalum.	R-4720
5	2	D1, D2	Diode, 1N4004 (or 1N4007).	R-3204
6	1	U1	Adjustable voltage regulator, LM317K.	Z-6542
7	1	U1H	Heatsink (5DEG C/W)	H-3400
8	1	TO-3	Mounting kit consisting of at least:	
	2		6BA x12mm R.H. setscrews	
	1		TO-3 Insulating kit	
			Heatsink grease	
	1		Matrix board 95 x 75mm (minimum)	
	4		Insulated standoffs (10mm) 25mm long fixing screws, nuts and lock washers.	H-1861

(NOTE: Catalogue numbers refer to Dick Smith. Equivalents should also available from other reputable electronic retailers, eg. Jaycar Electronics.

fected by the operation when it is on or off at either end.

Number lamps

There a number of ways in which the loco class number may be illuminated. For example, select a low current 12V incandescent strip lamp similar to that used in trailer taillights. Now as these use about three Watts of power (250mA nominal) and as the four NBR lamps will be on while the key switch is on then minimum night light power usage is all that is required. The number strips will be discussed in detail in the penultimate article in the 422 series by our friends north of the border. In the meantime just tape up the ends until this section is covered later.

Notes on head and tail light regulations

The following abridged regulations are documented here for operator information.

Note: head lamp is used as a general term referring to both the head light(s) and marker lights.

1. For night running, trains should be fitted with an effective head light, marker lights being optional.

2. The head light should be dimmed when:

i) stopping at or passing through a station,

ii) standing in the yards,

iii) approaching trains running in the opposite direction.

3. Subject to the dimming instructions, Drivers must have the headlight full on when approaching open level crossings.

4. When a train is drawn by two (or more) locomotives, the head lamps on the leading engine only must be lighted.

5. When a locomotive is travelling tender, bunker (or No.2 end) first, the lights must be carried in the same relative position as when travelling funnel (No.1 end) first.

6. Shunting engines (yard-pilots) equipped with electric head lights, such lights must be dimmed and a red marker light and a white marker light exhibited both in front and in rear. (VR only)

6a. Red light over each buffer, or if bufferless, then two red lights at each end. (NSW only)

7. Locomotives running light-engine during the day should display the headlight on the leading end and the white tail disc on the trailing end and at night, the headlight and two white marker lights on leading end and two red marker lights on the trailing end. (In NSW tail discs are no longer used)

Night running

In the case of miniature locomotives, if the driver rides a driving truck then the two red marker lights by night or a white tail disc by day should be displayed on the rear of the associated driving truck.

Where the above "regulations" vary for steam, electric or diesel-electric operations in other states, the headlight and marker light display controls on the 422 class miniature locomotive are versatile enough to accommodate the alternatives. The headlights are simple and require no further comment. However, to enable the marker light displays to be quickly set in accordance with the various prototype conditions, then some wholesale modifications and unnecessary complications to the circuitry would be required. This we consider would clutter the project too much.

Conclusion

This concludes my part in this interesting project and if you have any queries please pass them through our worthy Editor. Good luck and good running!

Please let the Editor know when you have commenced building the 422 class locomotive, or any other diesel outline locomotive, using similar electric traction control circuitry, and whether you are using the m.u. facility. We are interested to see the demand for future articles and news updates in the area of electric control technology.

References

Victorian Railways: General Appendix 1953, courtesy of Neville Levin.

NSWGR: General Appendix 1967 and 1973 Parts 1 and 2, courtesy of Mark Carney.

To be continued ...

Marine Plant — Burners and Boilers

Part one of a two part article describing simple marine plant methods

by Jack Henshall

Photos supplied by Jack Henshall. Drawings for publication by Dave Adams

Readers who have responded to Dave Harper's invitation to give their ideas on requirements for marine steam engines have limited themselves to only the engine itself. However, in a total steam installation the engine is the lesser portion, with the least manufacturing difficulties and cost. We need to put in much more thinking and discussion on the heart and soul of the plant: the fuel and its burner, and the pressure vessel with its associated fittings and accessories. Depending on their sophistication, these items could well cost three to four times the price of the simple engine currently envisaged.

Modest boilers, casings and burners are not complex or difficult, nor do they require costly tools or equipment to build. However, the pressure vessel and its firebox and casing are typically sheet metal constructions involving manufacturing processes different from the machining of engine components. Without press tooling, they are not cheap to manufacture. Kitchen table assembly of kits, including a tested pressure vessel, will not reduce the cost significantly. Home construction from scratch, using readily available materials, seems to be the solution for today's economic climate.

I'd like to start discussion on the requirements for burners and boilers by considering some of the factors to be considered with steam propulsion. Then I'll examine some of the design solutions used with steam plants.

Factors and options which have to be assessed may be grouped under the following topics:

- Type and size of model
- Fuels and burners
- Heat exchanger and pressure vessel
- Boiler configurations

Type and size of model

(a) Type of Model

The modeller has freedom to choose what he will build. However, whether steam can meet the power/weight requirements of the vessel chosen, and whether such a plant can be obtained, must be considered in the choice. A possible classification of ship types is:

- Recreational
  - hydroplane
  - runabout/cabin cruiser
  - river/lake launch
  - steam yacht
  - paddle/excursion steamer
- Commercial
  - trawler
  - tug
  - coastal freighter
  - tramp
  - bulk carrier
  - passenger/cruise liner
- Naval
  - steam pinnace
  - fast patrol
  - corvette
  - frigate/destroyer
  - cruiser/battleship
  - aircraft carrier

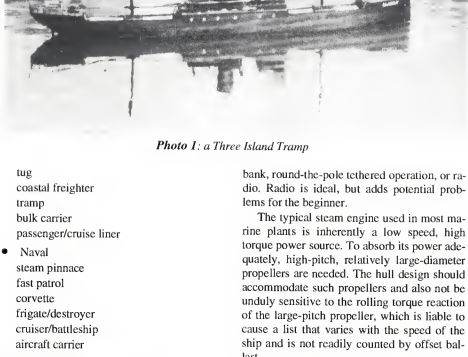


***Photo 1**: a Three Island Tramp*

Steam-driven models

Planing and fast-displacement hulls require high power-to-weight ratios that are not readily achievable by the type of plant under consideration for use by newcomers to steam. Flash steam can meet such power/weight ratios, but much experimental development is needed to match the characteristics of the burner, heat exchanger, engine, water pump and propeller — together with a high pressure, high temperature lubrication system — all necessary for reliable, sustained operation. Over the years, the model press has covered a number of fast runabouts using moderate flash steam (semi-flash). The enhancement of performance obtained is illustrated by the writer's launch operating with a dry boiler giving highly superheated steam directly from the boiler pump. The plant uses induced draft from the exhaust to create an inferno burning methylated spirit. When the manufacture and sales of the modest plant being considered have succeeded, it should be possible to extend the range of steam items to cover the needs of fast craft.

Fast craft have problems of control on the water: you need a mate stopper on the other bank, round-the-pole tethered operation, or radio. Radio is ideal, but adds potential problems for the beginner.

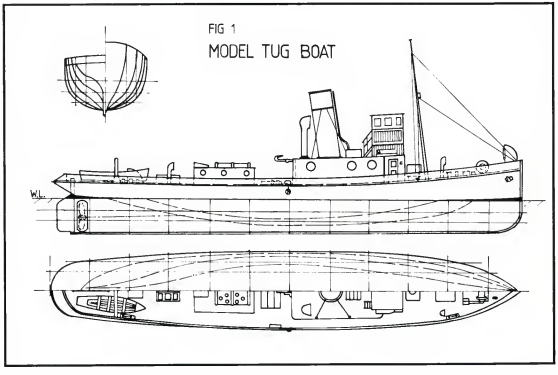
The typical steam engine used in most marine plants is inherently a low speed, high torque power source. To absorb its power adequately, high-pitch, relatively large-diameter propellers are needed. The hull design should accommodate such propellers and also not be unduly sensitive to the rolling torque reaction of the large-pitch propeller, which is liable to cause a list that varies with the speed of the ship and is not readily counted by offset ballast.

The familiar, under-fired, horizontal, single-drum boiler (commonly known as a "pot" boiler), with longitudinal water circulation tubes, is usually made large enough to hold water for a run of 20 to 30 minutes. The problem is, you need at least ½ inch — desirably more — from the burner wicks or jets to the bottom of the water tubes. Such a high, weighty boiler can aggravate a problem of roll stability that's inherent in models with large deckhouses or other top hamper, such as the control towers of major warships. I don't support the solution often advocated, namely increasing the beam and draught for greater buoyancy to carry ballast. It is better to put the superstructure on a severe weight reduction diet — light alloy construction, rolled tubes rather than solid rods etc. — and use an engine-driven feed pump supplying a smaller boiler with a higher specific steaming rate. Seaworthy models with close-to-scale hulls are achievable.

It isn't unusual to see new models on their initial sea trials operating without deck houses, hatch covers etc., to provide the burner with an adequate air supply. Naval

models with their minimum of openings, vents and doorways need every possible air entry opening to be used.

Raising steam on the bank of your local pond is far easier if the burner will operate under natural draft and not be dependent on a draft induced by an external means until the engine exhaust can do it. Ships with the engine room in the stern — such as tankers and modern container vessels — will need the boiler flue taken horizontally to the stack location, thereby limiting natural draft. Early ships of the steam age, in which the engines were little more than auxiliaries to sail, and early trawlers, have stacks of such a small diameter that steam-raising under natural draft is a long, drawn-out wait.



The Coburg Model Power Boat Club has devised a way of getting around this problem in small, briquette-fired Scotch return tube boilers. They use a screwed adapter to suit a bicycle pump connection, which is fed into the boiler feed pipe to supply air to the blower. The boiler serves as the air reservoir and the check valve as a non-return for the pump. Five minutes' leisurely pumping after starting the fire with hardwood soaked in kerosene is enough to raise steam to operate the blower. A plug cock isolates the pump adapter for normal boiler feed.

In models of tankers and other vessels with the engine in the stern, a better arrangement may be to have the engine in front of the boiler, with the prop shaft through the boiler casing. The engine-in-front configuration also suits launches and cabin cruisers, as it allows a smaller propeller shaft angle, even with a large diameter flywheel.

The simple displacement lubricator is the most reliable and cheapest means for supplying oil continuously to a steam engine. It is a generous provider of dark, sticky oil which, with an exhaust-induced draft boiler and without an oil separator in the exhaust line, soon spreads itself all over the upper decks. Thus robustness of construction, without fine detail, allowing a sluice with kerosene and a hose down after a day's outing, is essential for most steam-driven models.

All things being considered, newcomers to steam propulsion have much to gain by choosing a prototype from the heyday of reciprocating steam engines. Success is much more likely to come from vessels such as a "three island" tramp of World War I vintage (photo 1) or an early harbour tug (Fig 1) where the hulls have good block coefficients, adequate beam for stability, little top hamper, the stack in the right place and and a size for natural draft.

There seems little point in designing a model of a non-steam prototype to operate by steam.

A model tug built along the lines of the tug shown in figure 1 above.

Size of model

Having chosen the type of craft, the next decision is the size of model to be built. Some factors in this choice are as follows.

- Who is to sail our ship?

  Will the operator be the parent (builder) or the child? If children are to use the model, it cannot be large and heavy and it must have good seaworthiness — that is, cannot be too small either!

- Where is it to be sailed?

  Home waters could be:
  spa bath
  wading pool
  swimming pool (neighbours', naturally!)
  ornamental pond in nearby park
  local creek or river
  town water reservoir
  farmer's dam
  sheltered beach or large inland lake

  A model needs to be large to be pleasing on a large expanse of water; and it needs to have enough seaworthiness to survive the seas that can build up in large areas of open water.

Problems of control also have to be solved by using radio or a chase boat. For waters of say 150 to 200 feet across, hazardous sea states are unlikely and 40-inch (1-metre) models suit quite well. For smaller ponds, in which a longer sailing time between turnarounds, smaller models with the lower "scale" speeds are better.

- Cost

Materials to scratch-build even a large model are unlikely to be a financial burden, but a marine plant for a large hull could upset your budget.

- Handling and transport

Having to have a mate to handle and launch your pride and joy can limit its use. A boat of about 20 to 25 pounds would be comfortable for one-person outings, provided it does not have to be carried too far. Not all cars will carry a 5 foot model and vehicle access close to the sailing water is needed. In earlier days, push bikes were the main transport, a 15 pound, 40 inch model plus fuel, tool kit and refreshments were about the limit.

- Storage

Some thought should be given to storage, as a large model is not readily lifted on to an out-of-the-way shelf and can take up a lot of space along a shed wall. A model up to perhaps 36 inches is usually acceptable as an ornament on a household shelf or mantlepiece, but can be a dust collector if left unused for long periods.

- Scale

Having some idea now about the size of model suited to our purpose, and the type of vessel desired, the scale of the model has to be settled. From considerations of the scale, the amount of detail required for an impression of the prototype at a distance can be decided. A working model steam ship cannot be fragile, as collisions and sinkings will occur no matter what precautions are taken. Further, the mixture of bilge water and oil that accumulates in steam models has to be removed, so robustness for ease of cleaning is vital if the model is to survive many outings.

Fuels and burners

- Safety

It is of paramount importance that only the safest concepts and practices be presented to enthusiasts new to steam, who may have little knowledge of the hazards of steam plants. The designer of steam equipment, with experience of the dangers associated with the choice of fuel, the way it is burnt, and the integrity of the pressure vessel, has a prime responsibility for the safety of the user/builder and onlookers.

Hobby magazine publishers likewise go to much trouble to ensure that material on home construction does not have undisclosed dangers, and conforms to the appropriate sections of industrial and model codes of practice for safety in such matters as handling and storage of flammable liquids and gases, construction and testing of pressure vessels, and toxic waste disposal.

In order of safety against the likelihood of serious injury to the user, fuels used in miniature steam plants include: solid fuel, hardwood, charcoal, briquettes and coal, lighting kerosene, methylated spirits, liquefied petroleum gases (LPG) and petrol.

Some comments on suitability, dangers and burners are as follows.

Solid fuel

This group (including wax-soaked firelighters) is by far the safest of all. It is readily obtainable in one form or another and there are no problems with storage and handling. For most applications, combustion relies on draft induced by the engine exhaust. Therefore, if the boiler is out of water or a jammed propeller has stopped the engine (it's surprising how often cigarette packages, ice cream dixies and chip packets get caught in propellers) there is no draft and the fire dies. Wonderful safety! The greatest danger is from the box of matches for lighting up and the odd local burn from contact with steam pipes etc., which is a normal hazard to steam operators. A typical firebox charge in a boiler for a 1-metre ship would last 12 to 15 minutes and with the boat slowing down gradually as the fire gets low, there is ample warning to initiate recovery and refuel. And nothing beats the visual effects of real smoke, particularly on a calm, late afternoon run. Main disadvantages are the costs and building time for an engine-driven feed pump and its associated fittings.

Lighting kerosene

A relatively safe liquid fuel having low volatility at ambient temperatures, hence no flammable or explosive gases from open containers or spillages. If ignited, the liquid burns with a readily visible yellow flame with lots of black smoke and is not difficult to smother. Burners commonly used in steam plants have the fuel container pressurized to force the liquid into heating tubes in the flames. The kerosene then becomes gaseous and is fed (typically) through a fine jet, inducing air into a mixing tube from where the combustible mixture can be burnt efficiently.

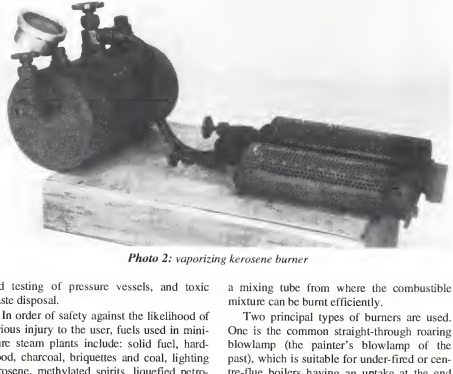


Photo 2: *vaporizing kerosene burner*

Two principal types of burners are used. One is the common straight-through roaring blowlamp (the painter's blowlamp of the past), which is suitable for under-fired or centre-flue boilers having an uptake at the end opposite the burner. The other (photo 2) is the silent blue-flame area burner, somewhat akin to the Primus® camp stove, but having a horizontal mixing tube with the combustible mixture burning from slots or fine holes in the top of the burner tube. This is an ideal burner under most types of water and fire tube boilers: it's clean, quiet and efficient. Both types are somewhat inconvenient to use, as the burner has to be pre-heated to start, the pressure in the container needs restoring as the fuel is used, and care is needed to ensure the fuel is absolutely clean — otherwise the jet soon clogs up. The blowlamp burner is favoured by the flash steam fraternity, as large hot flames completely enveloping the boiler coils are readily obtained. The silent kerosene burners were used in many steam cars, most notably the Stanley, and in the Clarkson London steambus.

The danger from these burners happens when the fuel is not fully vaporized in the heating tubes and a stream of burning kerosene is thrown from the jet, hopefully into the firebox, which therefore should be sealed for at least the bottom ½ inch to contain the burning fluid until the fuel can be shut off or the pressure relcascd. The pressure in the fuel tank — usually provided by a bicycle pump — is a modest 10 to 15 psi.

The burners are not critical in design or manufacture, but this system is inconvcnient and it does not seem warranted to use them when safer, more convenient fuels can meet most requirements for models based on commercial or naval prototypes.

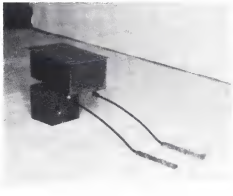
Methylated spirits

Alcohol, the basis of methylated spirit, has been used for centuries in small household heating lamps and since the middle of last

century in thousands of spirit-fired steam toys, without involving restrictive safety regulations. It is freely available in supermarkets and hardware stores. The only hazard warnings are not to use it near open flames or smouldering material, and that it's a poisonous substance. Considering its availability, storage requirements, ease of replenishment into fuel tanks and its easy ignition with consistency of burning, it is, without doubt, the most convenient of fuels for model ships. It suits small (12 inch LWL) to medium (40 inch LWL) boats and is quite usable in large (60 inch) models.

The fuel burns with a soft, light blue flame that is almost invisible in sunlight. The greatest danger occurs if the lamp is still alight when the fuel container is replenished.

Users must recognize this hazard and learn to shade the wick area to ensure all is safe to refuel (hats have many purposes!) Under natural draft it is ideal for the more sedate commercial and naval craft and under induced draft can power fast displacement hulls. For effective natural draft, care is needed in designing the boiler enclosure to ensure that there is a free gas passage past the heating



A simple methylated spirit burner as used in the ship below — photo 3 — this type of burner is also suitable for the boiler shown in figure 4. Note the minimal wick height and the ability to fit as large a fuel tank as the ship can carry.

Table 1 Properties of Saturated Steam

Total pressure in lbs per sq. in. above vacuum p	Temperature in degrees Farenheit t	Heat in liquid from 32° in heat units q	Heat of vaporization or latent heat in heat units r	Total heat in heat units from water at 32° H	Density or weight of one cubic foot in lbs. $\frac{1}{s}$	Volume of 1 pound in cubic feet s	Total pressure in lbs per sq. in. above vacuum p
1	101.84	69.8	1034.7	1104.5	0.00300	333.1	1
2	126.15	94.2	1021.9	1116.1	0.00578	173.1	2
3	141.52	109.6	1012.2	1121.8	0.00845	118.4	3
4	153.00	121.0	1005.5	1126.5	0.01106	90.4	4
5	162.26	130.3	1000.0	1130.3	0.01364	73.3	5
6	170.07	138.1	995.5	1133.6	0.01616	61.9	6
7	176.84	144.9	991.4	1136.3	0.01866	53.6	7
8	182.86	150.9	987.8	1138.7	0.02116	47.26	8
9	188.27	156.4	984.5	1140.9	0.02362	42.36	9
10	193.21	161.3	981.4	1142.7	0.02606	38.37	10
14.7	212.00	180.3	969.7	1150.0	0.03734	26.78	14.7
15	213.03	181.3	969.1	1150.4	0.03805	26.28	15
20	227.95	196.4	959.4	1155.8	0.04978	20.09	20
25	240.07	208.7	951.4	1160.1	0.06140	16.29	25
30	250.34	219.1	944.4	1163.5	0.0728	13.74	30
35	259.26	228.2	938.2	1166.4	0.0842	11.88	35
40	267.26	236.4	932.6	1169.0	0.0953	10.49	40
45	274.46	243.7	927.5	1171.2	0.1065	9.387	45
50	281.03	250.4	922.8	1173.2	0.1176	8.507	50
55	287.09	256.6	918.4	1175.0	0.1286	7.778	55
60	292.74	262.4	914.3	1176.7	0.1395	7.166	60
65	298.00	267.8	910.4	1178.2	0.1504	6.647	65
70	302.96	272.9	906.6	1179.5	0.1613	6.199	70
75	307.64	277.7	903.1	1180.8	0.1722	5.807	75
80	312.08	282.2	899.8	1182.0	0.1829	5.466	80
85	316.30	286.5	896.6	1183.1	0.1938	5.161	85
90	320.32	290.7	893.5	1184.2	0.2047	4.886	90
95	324.16	294.6	890.5	1185.1	0.2153	4.644	95
100	327.86	298.5	887.6	1186.1	0.2256	4.432	100
105	331.42	302.1	884.8	1186.9	0.2362	4.233	105
110	334.83	305.6	882.1	1187.7	0.2471	4.047	110
115	338.14	309.0	879.5	1188.5	0.2580	3.876	115
120	341.31	312.3	876.9	1189.2	0.2686	3.723	120

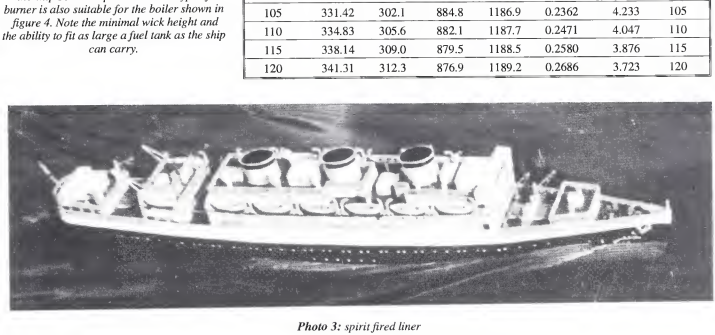


***Photo 3:** spirit fired liner*

surface to the flue. At least ¼ inch clear space for gas flow is required; otherwise the cooler surfaces will chill the burning gases, extinguishing local burning. The casing above the heating surfaces should be like a canopy leading to the flue; otherwise, dead pockets can be created, limiting the effective heating surface to that directly under the flue. Flues need to be of ample area for free flow of the rising burnt gases.

Commonly, fuel is burnt from wicks in light gauge metal tubes, with the lower end of the wick immersed in the spirit. The fuel level in the container feeding the bottom of the wicks cannot be above about ¼ inch below the top of the wick tube. The fuel initially burns around the periphery of the wick where the fuel vapour is in contact with the air. The vapour from the centre of the wick rises until it can burn with the surplus oxygen in the rising gases: hence large-diameter wicks produce long flames. Thus, for good combustion in a short flame, as needed under most marine boilers, the wicks should have maximum periphery with the smallest area — a strip wick — with provision for a good air supply to the full length of both side s of the wick.

If air can be supplied from underneath the wick, an annular wick could be considered, with the hole diameter at least five times the width of the wick. In many marine plants, the height under the boiler is limited, hence long wick tubes cannot be used and the fuel tanks are therefore limited to quite shallow containers that restrict the duration per fill for plants with engine-driven boiler feed pumps. The chicken feed system, using the level of the fuel in the wick reservoir to control the air bleed into an otherwise sealed main tank, can be used for extending the time of run per fuel fill.

Burners with wicks having free access to a fuel supply are not satisfactory when used with air to the burner being induced by the engine exhaust. The continually increasing rate of burning from the continually increasing rate of steam generation soon empties the

Table 2 Boiler Information

Boiler type figure number	Photograph number	Drum diametr (inches)	Drum length (inches)	Tube diameter (inches)	Number of tubes	Heating surface (inches)	Fuel	Draft	Engine capacity (cubic inch per rev)	Hull type	Hull length	Comments
3		1¼	4	3/16	2	20	M	I	0.02	Trawler	16	More steam than the engine can produce
3	4	2	4¾	¼	3	40	M	I	0.12	Tug	28	An energetic performer
3		2	6	¼	4	55	M	N	0.24	Tramp	36	An easy to run unit
4		2	6	¼	6	100	M	N	0.34	Corvette	40	Ample reserve power
5	5	1¾	4¾	¼	13	95*	M	I	0.24	Launch	32	A fast craft
6	6	2	4	¼	58	190*	K	N	T	S. Yacht	36	Turbine experiment continuing
8	7	4	4	¾	2	45	B	I	0.24	S. Yacht	36	Replacement for turbine plant
8		4½	4½	¾	2	60	B	I	0.38	Tug	32	Well driven heavy vessel
9	8	2	4¾	3/16	56	137*	K	N	T	Liner	40	Replacement hull and boiler for improved safety and seaworthiness

* Includes feedwater and superheater

Fuels M = Methylated spirits
K = Kerosene
B = Briquettes

Draft N = Natural
I = Induced exhaust

Table 3 Boiler Recommendations

Boiler type figure No.	Drum diameter (inches)	Drum length (inches)	Tube diameter (inches)	Number of tubes	Heating surface (square inches)	Fuel	Draft	Engine capacity cubic inches per revolution	Typical engine bore (inches)	Typical engine stroke (inches)	Hull length (inches)	Ship type
3	1½	4	3/16	4	30	M	N	0.05	¼	½	20	Commercial
							I	0.05	¼	½	24	Fast Naval
3	2	6	¼	4	55	K/M	N	0.25	½	⅝	36	Commercial
						M	I	0.25	½	⅝	30	Tug
7	1½	4⅜	¼	21	170	M	I	0.4	½	½T	48	Fast Naval
						K/M	N	0.5	½	⅝T	60	Commercial
8	4	4	¾	2	45	B	I	0.25	½	⅝	30	Tug
			Firebox 2¼ dia.					0.25	½	⅝	36	Commercial
8	4¾	5	¾	2	70	B	I	0.4	½	½T	36	Tug
			Firebox 2¾ dia.					0.4	⅝	⅝	48	Commercial

Notes:
"T" under Engine stroke indicates Twin cylinder.
All engines have a double acting cylinder.
The heating surface does not include the feedwater heater or the superheater.
Feedwater heater = 8 to 12 square inches of heating surface.
Superheater = 15 to 25 square inches of heating surface.
K/M = Kerosene or Methylated Spirits.

most liberal of fuel tanks. Such energetic exhibitionism from the burner would delight any flash steam fan, but is not really suited to comfortable cruising. With an induced draft, the rate of fuel supply to the wicks needs to be control led. A simple burner proved to be satisfactory in many models comprises an ⅛ inch OD tube, gravity fed through a fine needle valve from the fuel tank to under the boiler. The tube inside the firebox is drilled with 1/16 inch diameter holes at about ½ inch pitch, sealed at the end and wrapped with a loose wick. In days past this was asbestos cord, but a strand form a cotton sash cord is just as good although not as long-lasting.

Ample air vents along each side of the burner, either from underneath the boiler case or in the bottom of the sides, are essential. A shallow leak-proof tray with a layer of absorbent material placed under the burner tube will contain any small excess of fuel. The needle valve, held away from the plant over a flame-proof dish, is adjusted until the fuel does not drip from the burning lamp. Once the engine is running with the induced draft operating, the valve can be opened to suit the owner's enjoyment. Under these conditions the fuel is not burnt efficiently, but lots of heat is released in a small volume, which is ideal for destroyers or other fast displacement craft. With a little experimentation, a plant using such burners with induced draft could be a workable preposition for a planing hull.

Methylated spirits is not only for toys! Photo 3 shows a 40 inch model, spirit fired with natural draft. Using a boiler feed pump, and crosshead driven as per common marine practice, the run duration for a full fuel tank is close to 1½ hours, or at a gentle pace 2½ hours, which is a pleasant afternoon's enjoyment.

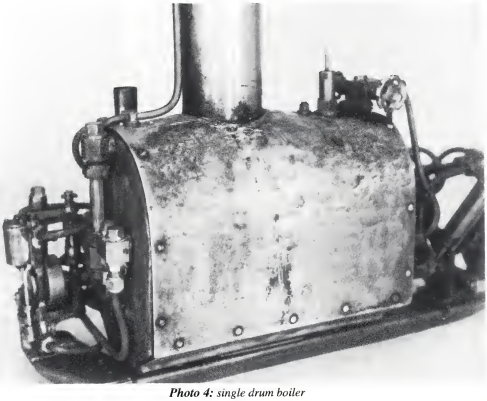


Photo 4: *single drum boiler*

Liquefied petroleum gases

With increasing use in cars and camping gear, the hazards of these heavier-than-air gases flowing and accumulating in depressions are being publicized in motoring publications. What is not yet being circulated are statistics on these dangers and the major injuries resulting from such accidents. Industrial codes of practice for the storage and handling of these gases are in force. Approval for the design of heating equipments and the periodical testing of storage containers are also required. An in *Engineering in Miniature* discussed the pressure testing of storage containers for LPG and similar gases. The situation is quite daunting if the container is warmed by proximity to a boiler in an enclosed hull. Only unmodified, commercially approved appliances should be used. We will have to accept their excess volume and weight and hope that a manufacturer of LPG stoves realizes that a market for a small container and burner for model steamers could be developed. A replenishment system, approved for public use, to refill the small container from a larger supply is needed for a completely convenient application.

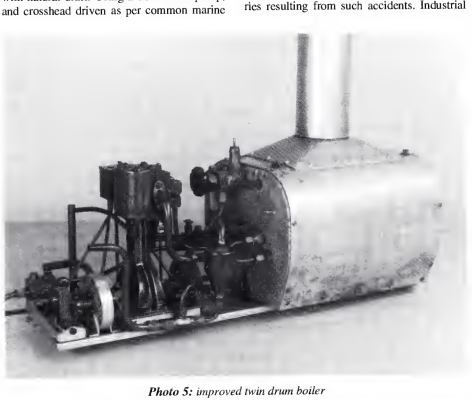


Photo 5: *improved twin drum boiler*

Petrol

Although petrol burning irons and brazing lamps were freely marketed at the turn of the century, they have now been entirely superseded by safer and more convenient equipment. Petrol or petrol-kerosene shandies are commonly used by experts in flash steam to obtain the high performance needed for record breaking. The hazard from the heavier-than-air petrol vapour near open flames is well known, and makes the use of this fuel undesirable for modest steam-driven models.

Heat exchanger and pressure vessel

It has long been accepted that 100 square inches of heating surface would evaporate one cubic inch of water per minute in model boilers. However, this figure has now been qualified as only generally applicable to the external surface of a simple "pot" boiler.

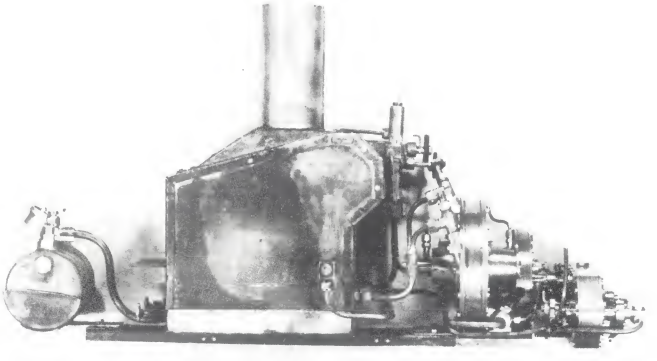


Photo 6: *transverse drum boiler*

However, over four times this modest evaporation rate can be achieved where the hot gases can be made to pass over the heating surface with greater turbulence, such as in locomotive-type firetube boilers, or where the water circulation can be enhanced through inclined tube banks as in Babcock or Yarrow designs. Conversely, if the hot gas does not pass over any part of the nominal heating surface, lower rates of evaporation can occur.

The evaporation rate is the ability of the heat exchanger to transfer heat from the burner to the water contents of the boiler. It is normally measured from and at the boiling point of water at atmospheric pressure, i.e. 100 degrees Celsius, and is readily determined by steaming the boiler with an open safety valve for a definite time in minutes with the boiler being weighed at the start and finish of the test time. If the burner can be supported in place under the boiler independently of the boiler casing, then with the boiler on the kitchen scales the weight can be recorded over a number of minutes.

From steam tables (such as Table 1) listing the volume per pound of steam over a range of steam pressures, the volume of steam that the boiler would produce at its operating pressure can be calculated from the evaporation rate — either measured or estimated from the calculated heating surface using a figure of merit assessed as applicable to the configuration of the boiler and its firebox. From the displacement per revolution of the projected engine size, an appreciation can be obtained of the probable engine speed, again with some allowances for steam leakages and ignorance of all factors. Such calculation, although interesting and absorbing to carry out, can only be a guide to the heating surface required for a given engine in a given hull. Perhaps, with some of our colleagues looking for computer exercises, data could be collected and processed on the many factors affecting the performance of a miniature steam plant, enabling better plant/hull matching than the voice of experience saying such-and-such boiler is needed for such-and-such engine in your hull. In the meantime, some boiler configurations and sizes for a number of successful steamers are given in Table 2.

To be continued...

SAVE THE COAL

The volume of air required varies with the volatile nature of the coal supplied. To fire a locomotive efficiently and economically, the required volume of air must be admitted through the fire grate and the firehole door.

Maitland coal contains a high percentage of volatile hydrocarbons, it burns freely and if not correctly fired, can entail considerable loss. To obtain the best results, admit a plentiful supply of air through the firehole door to assist in burning the gas which might otherwise be lost.

Correct firing will result in less manual labour and reduce fuel consumption.

Reprinted from *Handbook on the locomotive,* Victorian Railways 1951. C.H. Wear Collection.

The Early Machine Tools

by Don Payne

You know the feeling. With fear and trepidation you prepare to take the final cut on the bore of the steam cylinder of your latest project. When the job's over and confirmed for size, there's nothing like that feeling of sheer relief!

Have you ever pondered the means by which early steam engines were made, and what machine tools were available for their construction?

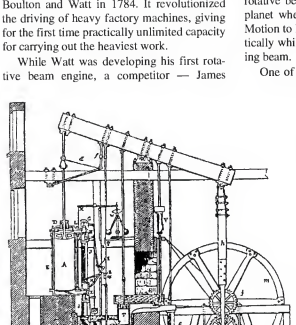
The steam revolution

1. Boulton and Watt's Soho Foundry, Birmingham

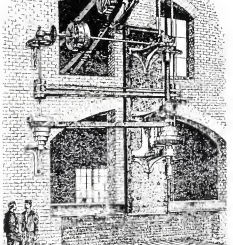
It is generally recognised that the modern industrial era began when mechanical power, in the form of the steam engine, was introduced — particularly that produced by James Watt (1736-1819). Before this, factory power was supplied primarily by water wheels.

Watt's earliest steam engines were only pumping engines, but at the insistence of his partner, Matthew Boulton, the first rotative steam engine was produced by the firm of Boulton and Watt in 1784. It revolutionized the driving of heavy factory machines, giving for the first time practically unlimited capacity for carrying out the heaviest work.

While Watt was developing his first rotative beam engine, a competitor — James Pickard — availed himself of industrial espionage and patented the crank in 1780. Watt was thus prevented from using cranks.



*2. Watt's **sun and planet** wheel drive*



3. An example of the "modern" Soho Foundry machinery, a boring machine, circa 1895

Undaunted by this setback, Watt invented the "sun-and-planet wheel" drive in lieu of the crank. While lawyers battled out the legality of the patent on the crank, Watt built the first rotative beam engines. He used the sun-and-planet wheel and his famous Watt's Parallel Motion to keep a rigid piston rod moving vertically while attached to the end of an oscillating beam.

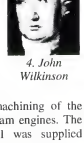
One of these engines, which first operated in the Whitbread Brewery on 23 June 1785, was used there for 100 years. Now located in the Powerhouse Museum, Sydney, it works regularly under steam for demonstration purposes.

All by hand!

The only metal that Newcomen, and later Watt, had available for steam engine cylinders was cast brass or bronze. These cylinder castings were finished internally by hand to fit the piston: a very slow and laborious task!

The advent of cast iron from the newly established iron foundries at Coalbrookdale, Shropshire, opened up a new era for making steam engine cylinders and other parts from cast iron.

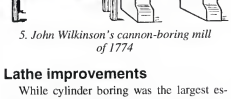
First accurate boring



4. John Wilkinson

Steam power showed up the inaccuracy of existing tools and appliances. John Wilkinson (1726-1808), a Scottish ironmaster who could be labelled the father of the machine tool industry, was one of the first people to improve their accuracy. Wilkinson invented the first boring mill for accurate internal machining of the large cylinders on Watt's beam engines. The power for the boring mill was supplied through toothed gears from a water-wheel.

Presumably the cylinders were cast at Coalbrookdale in Shropshire, were transported to Smethwick in Scotland for machining, and for finishing and assembly were sent to the Boulton and Watt works at Soho, Birmingham. This would have been a major feat with the transport system of the day. While the firm no longer bores steam engine cylinders, it still exists as Wilkinson Sword, making razor blades and cutlery.



5. John Wilkinson's cannon-boring mill of 1774

Lathe improvements

While cylinder boring was the largest essential machining operation on a steam engine, numerous smaller but equally important operations called for the use of a lathe or some comparable form of tool. The lathes in existence at the time were inefficient and by no means accurate, being but little removed from the ancient pole lathes in which intermittent motion in alternate directions was obtained by a cord wound round the work, the latter being rotated between dead centres. Cutting tools were applied by hand. Apart from the limitations in the power to drive the work, the rate of cutting was also limited by the strength of the worker in manipulating the tool.

A very early improvement in the lathe was the introduction of the live headstock and of continuous rotary motion applied by a treadle or another source of power. A great improvement in the utility and accuracy of the lathe was made when Henry Maudslay (1771-1831) introduced the slide rest and

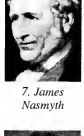
6. Henry Maudslay

quickly followed this up with an improvement of equally far reaching importance: the screw-cutting lathe. Many of the features of Maudslay's early lathes are the basis of our present lathes.

Maudslay may be regarded as the keystone of the edifice of machine tool development. As head of the famous engineering works which he instituted, Maudslay Sons and Field, he became the inventor and builder of many fine examples of steam engines. One, the Maudslay Table Engine of 1804, was the first steam engine to dispense with the beam. It was much favoured by the spinning and weaving industry. A very fine small Maudslay beam engine from Goulburn Brewery is exhibited at the Powerhouse Museum.

Shapers and planers

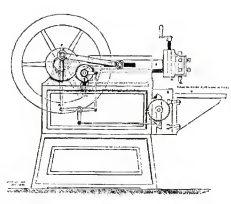
One of Maudslay's employees was James Nasmyth (1808-1890), who is chiefly remembered for his invention of the steam hammer, the most powerful tool available for the forging and hot-forming of metals. He was also responsible for the development of the drilling machine and the shaper. Apparently Nasmyth was prompted by the inefficiency and loss of time in producing accurate plane surfaces for the slides of machine tools by hand methods.



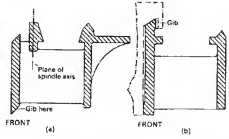
7. James Nasmyth

Another protégé of Maudslay was Richard Roberts (1769- 1864), who tackled this same problem from a different

8. Richard Roberts



*9. Nasmyth's "steam arm": although he called it a **planing** machine, it was the genesis of the modern **shaping** machine.*



10. Cross sections of Roberts' 1817 and 1820 lathe beds.

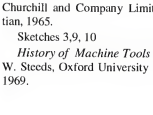
angle by inventing the planer. By mounting the work on the sliding carriage and the tool on a stationary support, this machine reverses the relation between the work and the tool as applied to the shaper. It is thus more suitable for heavy work — and its accuracy is higher because the cut is applied immediately over the centre of the bed.

Better measurement

11. Joseph Whitworth

Yet another of the Maudslay staff, Joseph Whitworth (1803–1887), became the father of modern engineering standards. He achieved fame for the screw thread which bears his name and for making accurate measurements possible. His measuring machine, developed from the original micrometer made by James Watt, improved many times on the facilities available to engineers for precision measurement.

When we use our lathes — which we can easily take for granted — it's good to reflect on these important people who contributed some of their features.



12. The modern micrometer — made possible by Joseph Whitworth's "measuring machine" developments.

Credits:

Photos 4,6,7,8,11 and Sketches 1 and 5.

Tools for the Job, L.T.C. Rolt, Charles Churchill and Company Limited, Great Britian, 1965.

Sketches 3,9, 10

History of Machine Tools 1700-1910, W. Steeds, Oxford University Press, London, 1969.

Walter Shellshear

Walter Shellshear passed away on the 27th February 1995 after a long illness.

Walter was one of the three co-founders of the original *Australian Model Engineering* Magazine (October 1987 - May 1990), and one of his regular articles was "The Engine Shed".

Railways was a major part of his life, he was building model engines even before he started his apprenticeship at the railway workshops at Cardiff, Walter was a fitter and turner. With a treadle lathe and a hand-shaper he constructed his 2½" gauge C36 class locomotive, some of the larger components, e.g. smoke box (which was machined out of a C36 class crank pin) was done at the "big" workshop.

Near the end of his apprenticeship Walter was transferred to Everleigh Workshops in Sydney. Here, as senior apprentice he was allowed to accompany a C36 in its post-overhaul trial run. One of his biggest thrills was when he was asked to drive the locomotive to Enfield and back — but watch the sticks and keep it at 10mph was the order. While in Sydney (1935) Walter travelled from Strathfield to the Sydney Society of Model Engineers at Ashfield in a double decker bus with his wooden suitcase which held his C36 loco. Later Walter joined the Sydney Live Steam Locomotive Society.

Walter married and not long after went to war. On his return he and his family moved to Cooma where he worked on the Snowy Mountain Scheme. There with a group of model engineers formed the Monaro Steam Locomotive Society and built a raised 2½" and 3½" gauge track (now at Canberra).

When Walter retired he moved to Canberra where he became involved in the Canberra Society of Model Engineers, the ARHS and became secretary of the Institution of Engineers. Walter fell in love with the NSW locomotive 1210 then on its plinth at Canberra Railway Station.

Having decided to model it, he would go and measure a part on the locomotive and then go home and built it in 5" gauge until finally, in 1987, the 5" gauge 12 class 1210 was finished.

This loco was his pride and joy and we spent many hours driving this loco over the next 6 years, until he moved to Sydney to a retirement village in December 1994.

Walter was a fine craftsman who built a number of locomotives, rolling stock, trams and clocks and gave encouragement to those wanting to become model engineers. He loved playing the organ at his church.

Walter will be sadly missed by all who had the honour and pleasure of meeting with him. Farewell our friend, may you travel in that train bound for eternal glory.

Gerardus Mol

Garratt Gossip

with John Cummings

Drawings for publication by Dave Adams

Thank you to those builders who have sent photos of their Garratt locos showing their various stages of construction. Unfortunately some of the photos can't be reproduced in these pages because they are either out of focus, they are too dark, or you can't pick out the subject from the background.

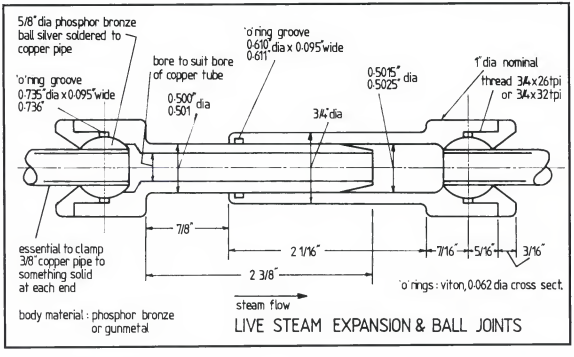
New Garratts coming

I have received letters from two readers in Tasmania. Both want to build an Australian Standard Garratt, one in 7¼" gauge and the other in 5" gauge. Early this year I received a letter from an old acquaintance who now lives near Coff's Harbour. He has plans, photos, etc., of the 2ft. gauge 0-4-0 + 0-4-0 Darjeeling Railway Garratt. He intends to build a model of it in 5" gauge.

Flexible steam connectors

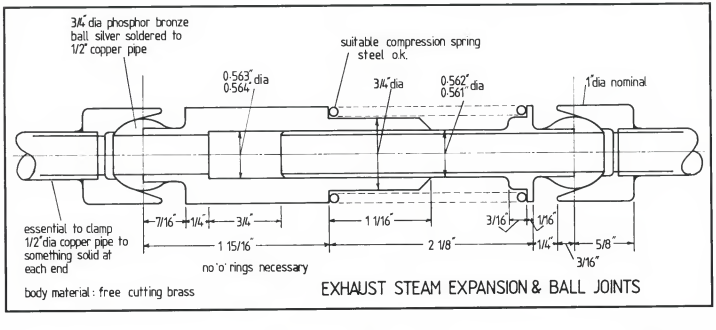
I finally met Frank Smith, from the Newcastle area, at the 1994 Wagga Wagga invitation weekend. He is building a NSWGR AD60 in 5" gauge. During our conversation, the subject swung around to flexible steam joints. Frank intends to use a stainless steel flexible tube product called *Anaconda*. He feels that if this product had been available during the Garratt building days, Beyer Peacock would have used it! Dick Phillips whose 7¼" gauge superheated Ceylon Government Railway loco was shown in AME issue 57, page 18. Dick used braided stainless steel flexible tube that is teflon lined and he says "at 100 p.s.i., it's quite okay, but over time it does get brittle." Dick's first set of hoses lasted approximately four years.

Bob Brown of Adelaide designed his own flexible steam joint based on H. W. Garratt's original concept. This is a reliable, easily made method that has the added advantages of reduced cost and long life! Our thanks to Bob for allowing us to reproduce his designs on this page.



Flexible rod connectors

I saw a catalogue recently, from a Brisbane based firm, where they had some beautiful ball-and-cup type couplings in small sizes — down to 8mm — which I thought would be ideal for Garratt reversing rod connectors. There are two versions: 1. Angle joints with rivet stud and hardened ball pivots or 2. Angle joints with threaded stem and hardened ball pivots. Call myself or our editor for details.



Birth of an S Truck

by Neil Matherson and Brian Carter

Photos by Brian Carter

The phone rang early one Sunday evening: it was the weekend after the subscription copies of the March-April 1995 AME were sent out. Neil Matherson was on the line, he had been prompted to call with information he thought I needed to know about his club's AGM held that afternoon. The topic of conversation shifted to the newly arrived AME and John Lyons' story of the S wagon construction. Neil mentioned that he had a go at making one because of the wet weather. After he told me the story, I knew I had to go and see this wagon! Especially after two more people rang telling me about it!

What you have to realize is, that although Neil's wagon looks the part and is very well built, it is only a close approximation to an S truck, as it had been constructed from materials available. The most amazing feature of this wagon is the construction time frame! Fortunately, Neil lives in a nearby suburb, so I made arrangements to visit him and photograph the wagon.

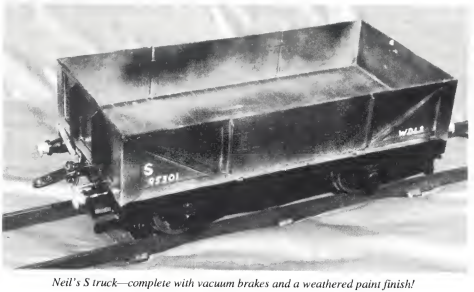
I'll let Neil tell you his story...

Friday, late morning, at last *the* magazine has arrived and what a nice S truck on the cover, just what I need to complete my mixed goods. It is raining steadily so I can't do the gardening: if I got stuck into the construction I could run it tomorrow at the Bankstown SLS running day.

Start time: Friday 1 p.m.

Wheels

I only had two spoked wheels left over from a previous project so I cut two discs of cast iron for plain disc wheels, they were soon finished and fitted to the axles. The axle boxes are made from ¾" square steel to avoid milling operations. A ⅝" diameter washer is brazed on for a flange and the box is drilled for small Timken® roller bearings. The horn blocks were cut out from ⅜" thick aluminium plate and fitted to 1" RHS cut down the longitudinal centre line to make two channel sections. The buffer beams were made from 1" square aluminium bar. The buffers are not sprung as they never come into contact with each other when in service. They are machined from 1" square aluminium bar for two reasons: first, alumium is easy to machine and second, it doesn't rust! The frame was finished and primed at 3.30pm.



Neil's S truck—complete with vacuum brakes and a weathered paint finish!

Top

Now for the top, the floor was cut from ⅝" ply because it was available. The ends were folded from two pieces of 16 gauge galvanized sheet 3½" wide. The little strips with their rivets were slow work but the body was finished and undercoated by 6pm.

Finishing touches

Saturday

Vacuum brakes are a must on all of my wagons, but as this truck is only light, a small diaphragm will do. I the cut brake shoes from a set left from some other job. I then made the linkage and fitted it to the chassis.

I then finished off the painting and sat it in front of the fan heater to dry.

A little while later, the paint was still a bit tacky, but I assembled the components and loaded the completed S wagon into the trailer ready to go to Bankstown.

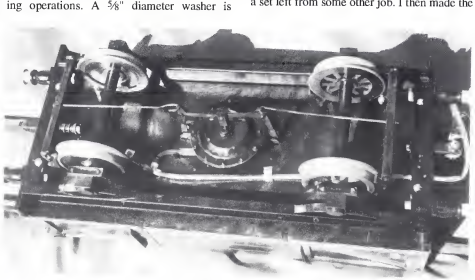
Time for lunch...

The trial run at Bankstown was very successful and the wagon performed its duty without fuss. I took the wagon out for another run at the Western District Live Steamer's track the next day, Sunday, and again the wagon performed admirably.

Epilogue

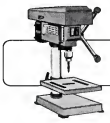
The photo session was very rewarding, especially afterwards, when we spent some time talking about Neil's models and how he built them. You will probably see more of his work in future issues of AME. Some reader's might remember his Carousel story in AME issue 48, May-June 1993.

The meeting concluded on a sad note: Neil mentioned that some time ago, he lent his 3½" gauge *Tich* loco to a fellow club member to use for a month. The person has since left the club and has not returned the borrowed locomotive. If that person happens to be reading this: how about doing the right thing by returning the loco? If anyone else knows this fellow and/or his whereabouts please let us know.



The underside view showing vacuum brake rigging, note the spoked wheel and disc wheel combination, a common occurrence on the real thing!

*Neil's 1" scale **Minnie** as the load.*



Turning Square Bar

Roydon Burk gives an alternative method of turning square section bar, using a 3-jaw chuck

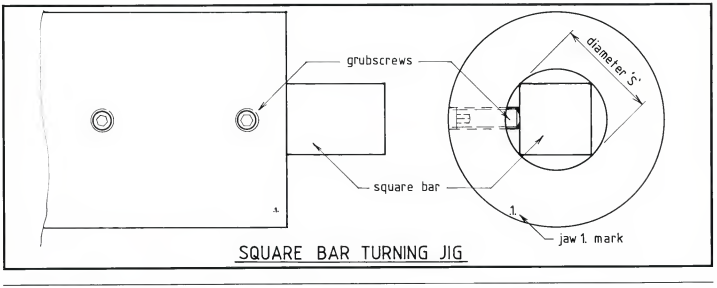
First, lightly clean up the square section bar you wish to turn, along the edges. Then accurately measure the bar across the section diagonals. Refer to diagram diameter S.

Now, chuck a piece of precision-ground or bright mild steel bar of suitable diameter — say 50 to 75mm long — in the three-jaw chuck. Centre-drill it, then drill out to near diameter. Finally bore to the exact diameter. Mark the round bar at jaw one.

Release the bar from the chuck and drill and tap M8 into the round bar, as shown in the diagram. Check the position of the tapped holes in relation to the jaw-1 mark, so that the tapped holes are accessible when the round bar is chucked. Insert two grub-screws into the tapped holes then return the round bar to the chuck.

This jig will ensure close uniformity of any machining operations with similar-sized square section bar. It saves a great deal of time compared to setting up in a four-jaw chuck. Naturally, a different jig will have to be made for each size of square-section bar that you need to turn.

To use, simply slide the square-section bar into the hole and lock it with the grubscrews, then proceed with the turning operation.



SQUARE BAR TURNING JIG

Increase Mill/Drill Cutter Clearance

by Peter Dawes

There will be times when you just need a few more millimeters of clearance between the table and the tool head on the mill/drill, e.g. Hafco RF25 or RF30 series. Well, it *can* be done by lifting the head of the mill beyond its normal limit, by hoisting it by its own bootstraps so to speak.

To raise the head

1. Remove the cap on the top of the column to remove the restriction this causes. This cap also controls the top end of the rack.
2. Wind the head up as high as it will go. It will be limited by the rack teeth running out.
3. Now lock the head with the column clamps.
4. Wind the rack itself up with the handle until 100-150mm or more project up at the top. Note that the top rack support is not important and can be left out without any fear, but that the bottom one carries the entire load and is critical.
5. Get a scrap piece of steel about 30 x 30 x 5mm and grind a bevel on one edge about 4 x 4mm at about 45 degrees. Put a heavy "strong" G-clamp around the column with this piece of steel under one foot of the clamp. Put a piece of scrap sheet brass under the other foot of the clamp to prevent marking the surface of the column. You will need four hands to do this. Clamp it up tight so that the bevelled packing piece fits up against the bevel at the bottom end of the rack, supporting it. It must be well clamped because the head is extremely heavy and this clamp is now going to support the entire weight for a few minutes.
6. Release the column clamp gently until you are sure the G-clamp is holding. Now just wird the head up on the rack again as far as you need. You can even wind it up past the top of the column as long as it still has some support there.
7. Lock the column clamp.
   This enabled me to gain 75 millimeters, which was enough to clear a ¾" drill over a tall job and still be able to change drills to work the hole up in steps. I ended up with more than 500 millimeters between table and bottom of the R8 socket on my particular Taiwanese mill.

Now to get it down again

1. Release the column clamp carefully in case the G-clamp might have slipped.
2. Wind the head down150mm or more with the handle.
3. Lock the head again with the column clamp.
4. Remove the G-clamp.
5. Wind the rack itself down with the handle until it is firmly back in its groove at the bottom.
6. Lock the head on the column, replace the cap on the top, and away you go again.

Axlebox Gauge

by Ted Murrell

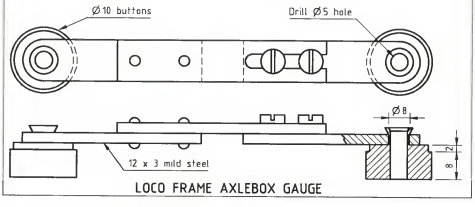
I have often wondered how other model engineers measure the centre distance of the loco chassis axlebox openings or hornblocks.

I have managed in the past by clamping two parallels, say to the left hand side of two openings and measuring with a vernier, etc. The actual distance is the total length less the thickness of one parallel. This method became tedious, so I made a gauge that makes the job a whole lot easier!

The gauge can be used in conjunction with feeler gauges to increase its accuracy, or just preset the gauge to the length required. Once the gauge length has been set, can be used as a drilling jig to drill the connecting rod centres. The buttons are rivetted into the bar by placing a 6.5 mm (¼") ball in the hole and pressing over in the vice.

The two rivets and adjusting screws have to be flush mounted on the inside.

Any other ideas?



LOCO FRAME AXLEBOX GAUGE

Suspension Tips

by Alex Russell

Does your pride and joy slip like mad when you get a bit of a load on behind? The usual solution is to add more weight. Then, on goes the weight and you now have a real rail crusher! Still no good? Now what? Perhaps the solution is with the coefficient of friction between the rail and wheel.

So you put several kilos of lead onboard and the engine gets worse with all that extra weight to lug around. Weight only assists adhesion to the point of a limited factor of adhesion. The best way to get around it is to add more wheels! However, there is another way — look at the springs. The answer to a lot of slip problems can be found by reducing the spring "stiffness". Your loco should shimmy a bit when its going. If it shoulders into the work — a sort of wag to the left and a wag to the right, you'll be able to put an extra wagon or two on the back! Don't believe me? Why not try it for yourself.

Highest rev/min?

by Jim Tennant

Officially the fastest steam locomotive is the London and North Eastern 4-6-2 No 4468 *Mallard* which hauled a four coach train down the grade of Stoke bank up to a maximum of 126mph in July 1938. With an 80 inch driving wheel diameter the rev/min was 529.

Unofficially the fastest steam locomotive may be a Southern Railway 4-6-2 Bulleid steam locomotive. H. Bulleid has recorded comments made by retired footplate crew that *Mallard*'s record has been broken many times by these locomotives. A *Merchant Navy* class locomotive with a 74 inch driving wheel diameter would require 572 rev/min at 126mph.

Another comparable performance was set by a Norfolk and Western 4-8-4 No 'J' 610. This locomotive hauled 15 carriages weighing 1025 tons up to a maximum of 110mph on the level near Crestline, Ohio on the Pennsylvanian Rail Road in 1945. With a worn driving wheel diameter of 68.5 inches the rev/min was 540.

The absolute record for revs/min is held by a New York Central 4-6-4 which in 1938 was used in tests to determine the critical speed for hammer blow and its reciprocal wheel lifting. The locomotive was run on greased rail up to a maximum of 168mph when pronounced wheel lift was noticed. With a driving wheel diameter of 79 inches the revs/min at this speed was 698.

So in looking at the various records that can be achieved on rail it is obvious that many variables have to be considered before a definitive record achiever can be determined.

Silver Soldering Boilers and Fittings

by Lindsay Brack

It must be remembered that cadmium based silver solders, and any other alloys containing cadmium, emit highly toxic fumes when heated.

Avoid inhaling fumes

Use these alloys in well ventilated places with local exhaust ventilation or efficient respiratory protection.

Warning: Protect yourself and others, Read and understand manufacturers labels.

Fumes and gases: Can be dangerous to your health.

- Read and understand Manufacturers instructions and safety practices.
- Keep your head out of the fumes.
- Use enough natural ventilation, exhaust ventilation at the fume source or both to keep fumes and gases from the breathing zone and general work area. Wear correct eye, ear and body protection.

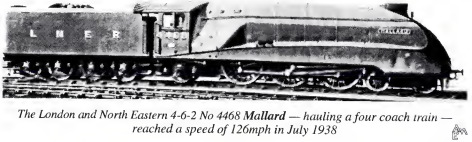
Silver Brazing

For the successful application of flame brazing, attention must be paid to the recommended joint design, selection of brazing alloy, preparation of surfaces and technique.

Technique

It is essential that the parts to be brazed are free from dirt, grease, scale, oxides and other foreign matter. Cleaning can be carried out with a wire brush, steel wool, emery cloth or chemically with a diluted acid or alkali solution. The acid recommended for the pickle bath is sulphuric normally 50:1 ratio of water to acid, remembering that the acid is added to the water and *not* the water to the acid.

The flux is mixed to a paste and applied by means of a brush to both parts as well as to the brazing rod or strip. The outer envelope of a soft oxy-acetylene flame or oxy-LPG should then be used to heat the parts. The heat input being general over the area to to be joined. The parts should be heated until the flux is molten along the line of the joint, Brazing metal is then added and heating continued just long enough to flow the alloy between the parts to be joined.



The London and North Eastern 4-6-2 No 4468 ***Mallard*** *— hauling a four coach train — reached a speed of 126mph in July 1938*

Fitting Steel Tyres to Locomotive Wheels

Ross Edmondson discusses the trials and tribulations of fitting steel tyres to miniature locomotive wheels

The case for and against the fitting of steel tyres on cast iron locomotive wheels has been discussed many a time around the roundhouse. However, after much searching through back issues of various magazines and club journals looking for some idea on how to perform this operation I finally came up with nothing! So, by picking the brains of a few elder statesmen in our society I finally decided to give it a go and see what sort of a job I could do. The following is a description on "how to do it" ... successfully.

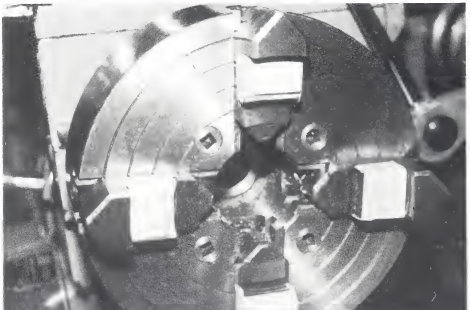
Homework

The first thing to do is your arithmetic to determine the finished outside diameter size required on the tyre (and flange) as well as the inside diameter and also the outside diameter of the cast iron wheel so that when it all finally fits to place nothing will come unstuck in service once your pride and joy starts to earn revenue for your society. As I was aiming for a shrink fit there is a general rule of thumb amongst model engineers to allow 0.001" per inch of diameter, plus 0.001". In my case I allowed a bit more than the rule of thumb ie. 0.008" or eight thou to you and me for a six (6") wheel. In other words, the tyre is 0.008" smaller than the wheel.

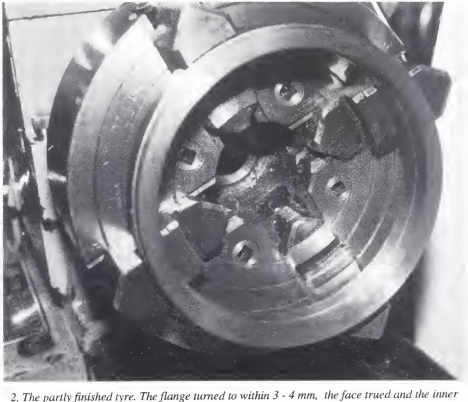
Wheels first

Having arrived at these crucial measurements the wheel is then turned in the usual manner. With the face out, clean up the face of the wheel and bore out for the axle. Do all the wheels in this manner before transferring them onto a mandrel whereby you can then reduce it down to the finished inside diameter size for the tyre. It can then be further reduced in size in from the face by 0.0394" or fourty thou to you and me, in for a distance of 0.375"

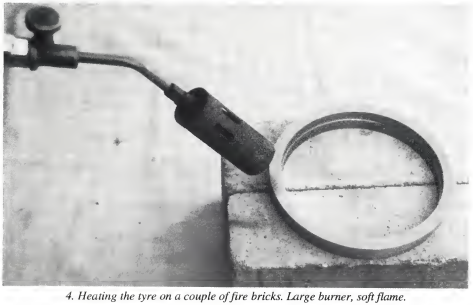
3. On the left the cast iron wheel showing the 1mm step, on the right the tyre ready for the shrink fit



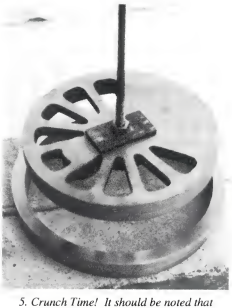
1. Small copper blocks are taped to the face of the jaws to protect the tyre rim and also allow the boring bar to machine right through the tyre bore without hitting the chuck jaw faces.



2. The partly finished tyre. The flange turned to within 3 - 4 mm, the face trued and the inner diameter turned showing the "step". Notice that the copper blocks are missing in this "staged" photo.



4. Heating the tyre on a couple of fire bricks. Large burner, soft flame.



5. Crunch Time! It should be noted that when inserting the wheel into the tyre to spread the bricks into a "V" to make room for the nut on the end of the rod!

which will actually give a fourty thou step or shoulder. This is where the tyre will eventually come to rest when you get to the stage of fitting them up. Do all the wheels the same, making a notation of the measurements per wheel so that when it comes time to turn the tyre you will have something to aim for. The next job is the turning of the tyre itself and this is done in the four jaw chuck. I would like to mention here that the tyres were purchased many moons ago from Hawleys who advertise occasionally in *AME*. When ordering it is recommended that you allow a little bit extra for machining on both the outside diameter and inside diameter of the tyre and also the face and rear of the tyre and in my case as the wheel itself finished up at 0.656" in thickness. When ordering the rings for the tyres, 20mm plate was specified.

Method

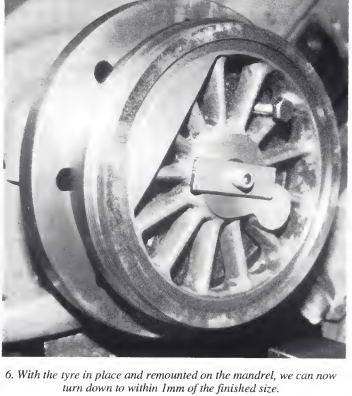
Using the four jaw chuck, and as it is necessary to bore right through for the inside diameter of the tyre, I packed the ring out from the jaws with four small pieces of copper bar, 3mm thick attached to each jaw with masking tape to give a little clearance for the tool and to avoid damaging the face of the jaws of the chuck when turning.

Note: once the tool comes into contact with the soft copper packing pieces, they will dislodge and let go (usually bounce into the swarf tray), so extreme caution is recommended when you get to this stage.

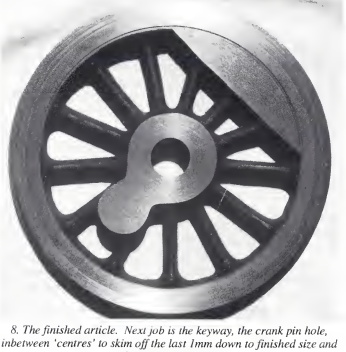
With the ring packed out, reduce the outside diameter for the flange down to within 0.125" from finished size, clean up the face of the tyre and then bore out to the required size. Once having done this you can then further bore out 0.0394" in for a distance of 0.375" This will then form the step or shoulder in the tyre for the wheel to rest on.

It should be noted that when mounting the tyre in the four jaw chuck, if excessive force (or brute strength) is used on the chuck key to hold things in place, you will actually distort the ring. You've been told now! All you have to do is hold it, not try and make it square!

Having got this far, if your game enough, you can then hold the tyre in the three jaw



6. With the tyre in place and remounted on the mandrel, we can now turn down to within 1mm of the finished size.



8. The finished article. Next job is the keyway, the crank pin hole, inbetween 'centres' to skim off the last 1mm down to finished size and then into the frames

chuck by the inside, expanding the jaws outward and further reduce the diameter of the tyre tread down to within 0.125" of the finished size for the tread. If this seems a little daunting don't worry about it as you can turn this down later in the final stages. Once again, you only have to hold the ring, not distort it into the shape of the inner workings of an orbital engine!

Before 500 readers of this trusty mag run off to grab a pen and paper to voice their disapproval of holding the tyre in the three jaw chuck by this method, don't despair. I know it is not a recommended practice and the chance of it coming loose whilst turning is always there. However with small cuts and plenty of them you'll soon wear it away.

Crunch time

Now that you have the wheel turned down to size and the tyre all ready to go, it is now crunch time to see if everything fits together and if you have done your sums correctly in the first place and your machining is up to scratch, there should be no problems. I have heard of some people who make up an implement out of ¼" rod with pointed ends in the shape of a Tee the same outside diameter of the wheel and once the tyre is heated sufficiently that this Tee fits into it without any problems, then is the time to fit the wheel into the tyre. In theory this sounds okay but then again how long are we going to live? In my case I didn't have the time to mess about with all this and decided to throw caution to the wind and take "pot luck".

Placing the tyre upon two fire bricks I gently started to warm it up with a PAG torch, large burner with a soft flame, in a circular motion. Once the colour started to change to a straw colour (you'll get the feel) it was time to drop-it-in You'll notice that the wheel itself was held with a bit of ¼" screwed rod and when it is inserted, it don't take long to get hot! At this point I would recommend that you have one of your junior hammers handy just in case it needs some gentle persuasion, but if you have done everything okay you'll have no problems.

Summary

In my case I was somewhat surprised at the ease of doing this job, however I should point out that with the first two tyres fitted up I got somewhat cockeye with the third one and that's when I came unstuck! The wheel was not fitted up square on (went in sideways)

That's when the junior hammers brother comes in handy!

If you listen to the "experts" they will all tell you that steel tyres give a much better grip than cast iron, last a lot longer and are no where near porous as the cast iron itself, especially when the track starts to get a little greasy.

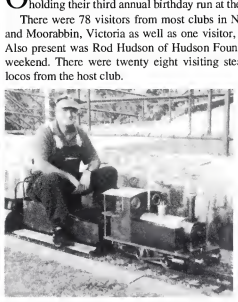
Why not give it a go? It's a very interesting exercise and oh yes, Good luck!

Lake Macquarie's Third Annual Birthday Run

Story and photos by Peter King

On 25 and 26 February 1995 the Lake Macquarie LSLS celebrated their 43rd birthday by holding their third annual birthday run at their track site at Edgeworth NSW.

There were 78 visitors from most clubs in NSW as well as from Maryborough, Queensland and Moorabbin, Victoria as well as one visitor, Stan Avis from the Staines Society in England. Also present was Rod Hudson of Hudson Foundry in Victoria who set up a trade stand for the weekend. There were twenty eight visiting steam locos, four petrol/electric locos and twenty locos from the host club.



*LMLSLS member, Dallas King and his new — yet to be painted — **Blowfly** class loco named **Maggot**.*

All participants enjoyed themselves with good company and fine and sunny conditions for the entire weekend. Added to this was the fact that even with a large number of locos present traffic flowed easily, with a few exceptions, largely due to the fact that the 3½" gauge is a raised track and is separate of all other tracks while the ground level 5" gauge and 7¼" gauge tracks are separated for over 80% of the journey.

Our first visitors arrived from Mudgee on Friday afternoon and enjoyed a clear run on the track late into the evening. The majority of visitors arrived on Saturday morning and it wasn't long before both steaming bays were busy with locos being unloaded and prepared as well as searching out the boiler inspectors.

One thing that is becoming more popular is the running of scale rolling stock. Over the weekend there were three freight trains as well as the GWR express passenger train owned by Reg Watters from Galston (HDMES). These carriages even had operating lamps on the tables in the dining car.

The awards were presented at 2pm in the shade of the 5" gauge station. There were two awards presented, one for the female club member of the year and the other for the male clubmember of the year. These awards were presented to Trish Burns and Phillip Little. Life membership was bestowed on long standing member Dave Evans. Soon after, the crowd moved to the 7¼" gauge track where the new track extension was officially opened by club president Tom Burns, followed by a ribbon cutting when double headed 7¼" gauge locos driven by Howard Civill and Frank Ford drove through the ribbon. Howard was the driving force behind the extension, which now gives a run of about one mile in length. With these duties over, everyone soon returned to playing trains. Trains continued to run into the night with the last locos heading for the "roundhouse" at about 10.30pm.

Sunday was our public running day and also saw the arrival of several more visitors and a few locos. Running continued throughout the day giving rides to a reasonably sized crowd. Visiting loco owners started packing up from about 2pm to prepare for the trip home.

From all reports received it appears that all visitors enjoyed themselves and we hope that they will visit us again on the last weekend of February 1996 for our fourth annual birthday run. We would like to thank all of our visitors for coming and making our birthday run a successful weekend.

Vintage NSWGR as 1214 and 5201 head a 5" gauge goods train somewhere "out there...". The smiling faces reflect the fun of live steaming!

Clarrie's Place
Part Two

By Dave Harper

In part one I gave an outline of Clarrie Hough's 10 acre property on the Sunshine Coast hinterland where I spent a most enjoyable day last year.

It seems that Clarrie and a group of friends have developed this remarkable track over the last three or four years, and they gather there at intervals for a day or more's steaming.

The New Year gathering, which I attended, lasts anything up to four days and a steady procession of people come and go day by day. Consequently I only saw a small proportion of the total that actually run on the line from time to time. I'm indebted to Neil Mackenzie and Steve Parrinder for the use of some of their photographs to give a wider appreciation of what goes on at Clarrie's.

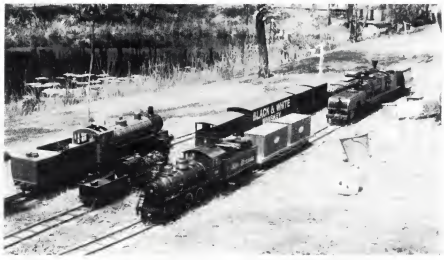
Neil has a "thing" about early QGR locos, and he and several friends have built models of many early prototypes such as the A10, A13, B12 up to more recent ones such as PB15s etc.

Gauge advantage

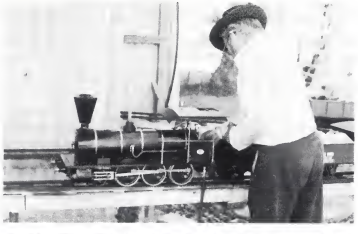
Incidentally, being 3'6" gauge full-size: the models are built to 1½" to the foot (or ⅛th scale) whereas most standard gauge locos are built to 1" to the foot (1/12) for 5" gauge. The result is that Queensland locos are bigger and more powerful models which can be quite clearly seen in some of the accompanying photos.

Another point which might clarify matters is that QR's quaint classification of locos uses a letter to denote the number of driving wheels and the number represents the diameter of the cylinders in inches.

So, the A12 has four driving wheels and 12" cylinders, the B13 has six drivers and 13" cylinders, and so on.



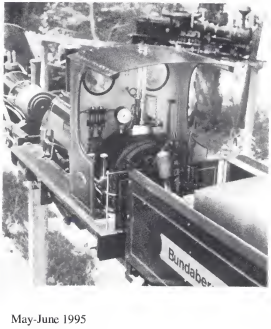
*A peaceful setting for Alec Simpsons' BB18¼ (extreme left) and his QR Garratt (extreme right).Centre rear are Neil Mackenzie's goods wagons and QR B12 while centre front is John Perry's American 0-6-0 and Steven Parrinders' **Grant**.*

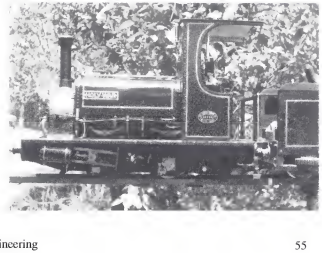


Neil Mackenzie fires up his QR B12

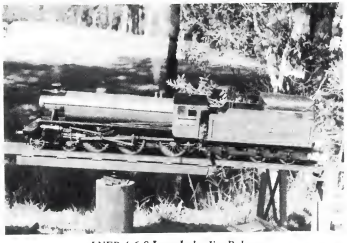
Neil's B12 (rear) accompanied by an A10

Photo: Neil Mackenzie

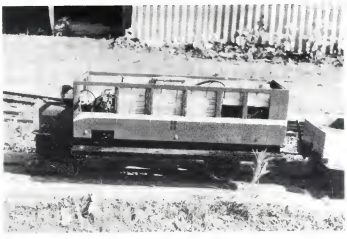




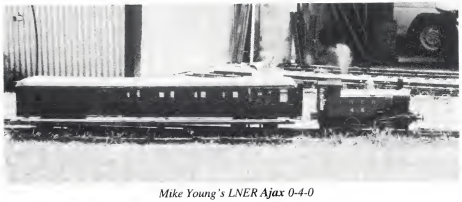
*Left and right: Two views of George Punters' Bundaberg Hunslet, **Holy War**.*



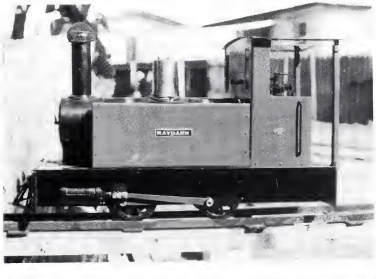
LNER 4-6-0 ***Impala*** *by Jim Palmer*



Ray Schilling's RM60



Mike Young's LNER ***Ajax*** *0-4-0*



Blowfly *by Ray Schilling*

Steven Parrinder's 5" ***Grant****, driven by his father, Ray.*

Photo: Steven Parrinder

It gives these guys great pleasure to have a line-up of these locos as shown in the photos, and even more so when some scale rolling stock is around too.

Apart from QR locos there were several delightful narrow gauge types including George Punter's Bundaberg Hunslet *Holy War* and Ray Schillings *Blowfly*.

Outboard motor transmission

Another of Ray Schilling's models was RM60, a QGR diesel railmotor that used to run on the Normanton to Croydon line. The model is powered by a Honda E300 generator motor and transmission is via the leg of an outboard motor. This gives forward/neutral/reverse gear positions plus 2:1 reduction and a right angle drive; very convenient! Apparently this is nearly standard practice for powering diesel type models, understandable when you consider the amount of engineering it saves.

American prototype is represented by Steve Parrinder's *Grant* pictured with his dad, Ray, at the controls. This picture clearly shows the difference in size between the 1:12 standard gauge and the 1:8 3/6" gauge models. The QR Garratt certainly makes an impressive model in this size.

British types to be seen were Jim Palmer's LNER 4-6-0 *Impala* and Mike Young's 0-4-0 *Ajax* on it's first outing after a major overhaul by Neil Mackenzie.

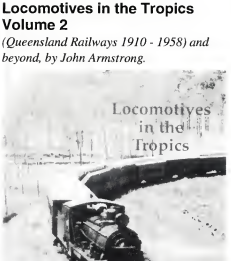
An invitation

Although Clarrie's place is private property and admission is by invitation only, Clarrie has said that any interstate modellers making the trek north would be more than welcome to stop off and have a run, so long as they realize that they must fend for themselves while there! Letters may be sent via the editor.

I see now why a day out at Clarrie's is a special occasion, and I am very grateful to have had the opportunity to experience it for myself. Thanks, Clarrie!

Locomotives in the Tropics Volume 2

(Queensland Railways 1910 - 1958) and beyond, by John Armstrong.



This softcover publication by the Australian Railway Historical Society (Queensland Division) follows on from volume one by the same author which was reviewed in the May-June 1994 issue of AME.

Volume two consists of a full colour cover, featuring a brown C17 4-8-0 on the front with a maroon Beyer Garratt and blue DD17 tank engine on the back, and 176 pages of well researched and illustrated text, including a small section of colour photos.

The forward includes additions to volume one, as more information has come to hand in the nine years since its publication. These additions include a photo of an A11 as rebuilt to a 4-4-0.

Tramway takeover

Chapter 5, Tramway Acquisitions, includes all locomotives taken over from private/shire tramways including the Cairns-Mulgrave Tramway, the extensive Chillagoe Railway, and the Aramac Tramway. Some Chillagoe engines were B15 goods types, the same as the QR's as described in volume one. The Aramac steam locomotive taken over by QR in 1958 was actually a Stephenson PB15 constructed by the Queensland Railway's Ipswich workshops for Aramac in 1924. It was the only PB15 they ever constructed. This is a most absorbing chapter on a little known aspect of the Queensland Railway's locomotive acquisition.

CME history

Chapters 6 to 10 contain the history of the Queensland Railway's modern steam locomotives ranging from the B17 4-6-0's of 1911 to the BB18¼ Pacifics, the last of which was placed in service in 1958. Each of these chapters deals with the era of a particular Chief Mechanical Engineer.

Some locomotive classes were constructed over long time spans resulting in large numbers of the one class, eg. 227 C17s were constructed over a period of 23 years. During this time the first and last members of a class could be fitted with different features, eg. roller instead of plain bearings, different diameter piston valves and even a change in cab and tender design.

All the chapters are packed with interesting information. Many of the photographs included are useful for those constructing models of the engines including two good cab views of the B18¼ and BB18¼ Pacifics.

Although mainline diesel electric locomotives were introduced to the Queensland Railway in 1951, only the diesel mechanical ones, of which there were a mere handful, are included. The mainline diesels are to be the subject of a separate book at a later date.

As in volume one, appendices give construction and withdrawal information of all the engines. Basic dimensions are in imperial units while an additional appendix includes the dimensions in metric units for locomotives covered in both volumes one and two.

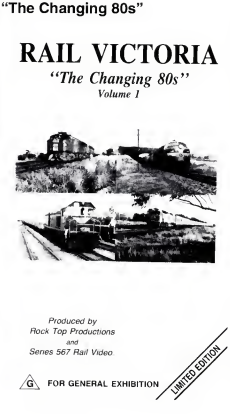
The book is thoroughly recommended for all interested in Queensland steam locomotives.

Price: $25.00 plus post and packing.

Available from: Hobby Mechanics, PO Box 785, Kenmore, Qld. 4069.

John Elsol

Rail Victoria "The Changing 80s"



The first opening scenes show the viewer what is in-store. The photography is very good — clear and sharp. The narrator provides a short history of Victorian Railways during the 1980s. The video is divided into five geographical groupings. Each group is preceded with a well produced graphical map is used to show the systems in Victoria's General Motors reign. This video brings back a lot of fond memories of working first generation GMs i.e. NSW 42 and 421 classes. There are some very unusual workings depicted, such as Australiaan National GM28 working the *Southern Aurora*. This old GM is almost a sister to the NSW SRA 42 class. The GM28s were nicknamed *growlers* because of their raucous exhaust and deep chant from the 567 engine. A series of run-by's taken at different locations, show what some railfans will put up with just to get that magic shot, early mornings, rain and fog not to mention skillful driving along country roads to get ahead of the train. Americans call these run-by's "Drive-by-shooting". The video shows what a real train looks like — with brake vans on the rear of freight trains — the way they should have stayed. Some scenes show the steep grades of the Great Dividing Range, several scenes feature NSW SRA 422 classes working through from Sydney — now a thing of the past.

The L class electric units are something else, I was lucky enough to ride in the cab of an L class while on a Busman's holiday.

The Melbourne-Geelong scenes show the great use of ANR 930s. These 930s were trialed in Sydney before being sent to SA.

The western line is the mecca for heavy freight train fans, with its steep grades and long banks. The views of Echuca show loco workings that no longer occur over Moana Bridge, the last scenes show a battle scarred S315 attempting the crossing. The information sheet with the video gives all the scenes in order of appearance also it gives the viewer some information about the type of engines and statistics of each class shown.

A nice touch would have been the inclusion of a map inside the paper cover, so non Victorians know where these places are.

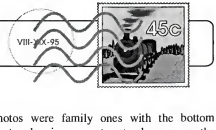
This tape is very interesting and well produced. The historical significance of the video should suit model engineers interested in non-steam traction.

Price: $29.95 plus $3.90 post & handling.

Available From: Series 567 Rail Video, PO Box 12154, A'Beckett St, Melbourne, Vic 3000

Mark Carney

Letter Box



What accident?

Sir,

There have been stong rumours circulating around NSW clubs in recent weeks that there has been a serious accident, reportedly late last year, involving two trains at the Central Coast Steam Model Co-op Ltd's miniature railway in Narara, Gosford.

As president of the society, I wish to refute in the strongest possible terms any inference that the safety credibility of this society has been tarnished in any way. There has been no accident, no injuries and no passengers rushed to hospital in ambulances. Any rumours to the contrary should be treated as malicious.

The Central Coast club is proud of its safety record and deplores any suggestion that its safety standards have slipped or safe working procedures have been compromised in any way.

Tom Winterbourne
President
CCSM Co-op Ltd.

Boxes on wheels!

Sir,

Having read your editorial comment *To Steam or Not to Steam* — AME issue 57 Nov-Dec 1994 — herewith my thoughts on the subject.

The question of "what to model?" is so often the "first seen not forgotten" image that fires one's imagination. Your comment on the availability of what can be seen on the present day railway systems is very true.

However, back to the basics of what constitutes a model: I am firmly of the opinion that "What suits the builder and doesn't appeal to others so be it". After all you only have to look in the mirror in a morning to realise we are not all like Tom Cruise or Elle.

Oh yes we can add a few "Fol-der-rols" to improve our image as we do to the models we produce. A steam engine has all the bits that make it go on the outside of its main component the boiler; so if you make a bit and stick it where you can on the boiler frame, it seems to be called detailing and therefore the ultimate in the eyes of those who they think look like Tom Cruise.

As for the present day motive power unit, all of the bits that make it go are carefully planned and installed inside the cover; all you are left to model are handrails; louvres; lifting lugs (wowee) and windows. How anybody can call that a "Box-on-wheels" in such a derogatory manner appalls me.

Modelling is the basic expression of one's imagination and to compare Mr Barry Potter's *Blowfly* with John Hill's *422* is an insult to both gentlemen as you are implying that anything greater than a *Blowfly* is the epitome of loco modelling and anything less than a John Hill 422 is the pits.

I would like to suggest you and others like you look into the mirror tomorrow morning.

I take *Australian Model Engineering* as a format to improve the standards of modelling, not to be used as launching pad to abuse the modellers who have not the equipment or skills of others.

Mike Tyson
Kellyville NSW

Thanks Mike, for your comments on my comment. Last time I looked I was certainly no Tom Cruise and — thankfully — no Elle!

I have the greatest respect for Messrs Potter and Hill as well as the models they produce. John's 422 is the basis for the battery electric version currently serialized in AME. The comment was not aimed at any model engineer who makes some kind of effort to reproduce a miniature replica or freelance design of a bona fide transport vehicle: land, sea or air. So often I see motive power projects that are a credit to the builder, while others are just thrown together in a near-enough-good-enough fashion. Perhaps the reflection is of our throw-away-society trend.

My comment ***was*** *aimed at improving the standards of modelling, which I'm happy to see you state as your reason for reading AME.*

I think I'll retire to the neutral corner... bmc.

Dr Bush's engine

Sir,

I was delighted to read the articles in the recent issue 58 titled *Memories of the Miniatures* regarding the late Dr Bush's engine. I had visited the doctor's house as a youngster and, like the writer of the above article, had not heard of the engine's whereabouts until I read in *Model Engineer* 15 April 1994 page 507 of a request for information regarding this engine from Australia.

I sent a letter to the *Model Engineer* containing copies of the information I had and which they kindly acknowledged and stated they had passed the information on. Unfortunately to this date I have had no further reply.

Further references located to date are:- *Railway Wonders of the World* 22 March 1935, *The Model Engineer in Australia and New Zealand* 1 March 1937.

I recently received some photos (photographer unknown) — copies enclosed. The small photos were family ones with the bottom photo showing me at a tender age as the "driver".

I hope you find all this interesting and that you may be able to use some of the information. Keep up the good work with the magazine.

Keith Hartley
Glen Waverley Vic.

The copies metioned were photocopies which we could not reproduce in AME. However, thanks Keith for sharing them with us...bmc.

Tourist attraction

Sir,

I read with interest the letter of Trevor R. Knight in your January issue regarding petrol driven miniature passenger trains.

We have in Horsham, a complex known as The Wool Factory, whose function is to provide suitable employment for handicapped persons. Among other activities, we are developings its extensive grounds as a tourist attraction. With the assistance of the local model steam society, a 5" and 7¼" track some 400 metres long has been laid and is being developed by the society, as a club track.

However, there is a pressing need for a petrol driven simple locomotive with a couple of passenger cars, which could be operated by mildly handicapped people at short notice, when tourists arrive.

If its design were simple enough, we could build it with our own resources.

We would welcome any assistance you or your readers could offer.

Jack Dare
Horsham VIC

Help!

Sir,

I have a little project underway and I find that I have reached a point where I could use a little help from AME readers. Any information on metal spinning or advice on how to make lens holders for carbide lamps would be greatly appreciated.

N.R. Endacott
Merrylands NSW

Blowfly book?

Sir,

I have recently become interested in model engineering and I'd like to build a loco. I'm told that the *Blowfly* is about the simplest loco to make, but to make it I'd have to chase up all those back issues.

Would it be economically feasible to re-print all the *Blowfly* articles into one magazine and sell it on its own?

Title it *Building a Steam Locomotive* so that you sell more. I recently bought a book by LBSC on building a *Tich* not because I wanted to build this particular loco but to find out how to go about making one. I'm told that the book is a reprint of articles that appeared in ME originally. It's a suggestion.

Eric Barlow
Springvale VIC

I agree, a Blowfly is an ideal first locomotive project for a beginner, although not necessarily the simplest. A Blowfly construction book is a project the AME team have discussed from time to time. However, we have to print at least 500 books to make it worthwhile. In the meantime, back copies of the articles are available. The complete set of 15 photocopied pages plus 12 magazines of various cover prices comes to $48.25; if the entire set is purchased in one go the price is $45 ...bmc.

Meet of the Millennium

Sir,

I want to inform your readers that the International Brotherhood of Live Steamers' *Meet Of The Millennium* in the year 2000 will be held at the British Columbia Society of Model Engineers track, Burnaby. B.C., Canada on 30 and 31 July and 1 August 2000. This track is in Confederation Park, 120 N. Willingdon Ave., Burnaby, which is a city within Greater Vancouver on the mainland of B.C. A popular misconception is that Vancouver is on Vancouver Island. Not so! Victoria is the capital city on Vancouver Island, B.C. and yes there is a flourishing club there, the Vancouver Island Model Engineers. Their track is 7½" gauge and a separate raised track of 5 and 3½" gauge and a ground level 5" gauge. The BCSME track in Burnaby has 7½" g and some model engineers from New Zealand have indicated they will bring outside frame narrow gauge locos that can readily have their wheels moved out 5/16" to run on IBLS 7½" standards. Our club is going to decide shortly if a ground level multi-gauge track of approximately 2000ft in 3½"/4¾"/5" and 7¼" g with no frogs in the turnouts will be built. We have a model engineer from South Africa who has offered to ship his 5"g 4-8-2 (11ft. long!) over if we have the track. So wait for confirmation though no doubt the club will build the multi-gauge track. Other 5"g tracks exist in Calgary and Winnipeg and further east. In the USA it's 4¾" g (1" scale).

Visitors to B.C. will be able to visit both club tracks as a 1½ hour inexpensive and scenic ferry ride takes you over to Vancouver Island where a gorgeous 3ft gauge Shay runs at the Duncan Forest Museum and in summer a 2-8-2 runs at Woss Camp in the far north of the island, and a standard gauge Heisler runs from Port Alberni. The Royal Hudson runs from North Vancouver on the mainland most days in summer.

Our club is organising this event to be something unique for the turn of the century, a meet to bring all interested large-scale train buffs, model engineers of all types of model together. We will assist with the handling through customs (no duty required) of models shipped for the meet as we did for our track opening in 1993. Gavin McCabe of Lower Hutt NZ shipped his gauge widened Hunslet over at a surprisingly reasonable cost and ran it at many 7½"gauge tracks. After our meet there are at least two other 7½" gauge private tracks close by that will be open to all. We are also working with clubs and private live steam tracks in the Pacific Northwest down to California for organised train-running after the Canadian meet. This would probably take the form of a group of live steamers, some with locos, travelling on an organised schedule to visit some superb layouts. These tracks would all be 7½" gauge. Overseas visitors would be especially welcome to participate. Many of the locals would also travel along. All the details will be spelled out well in advance so that groups and individuals can make travel arrangements well ahead to get the best rates.

We are still adding to our 7½" gauge track and hope to have about 10,000ft of mainline, much of it double track, so the passing parade of trains will delight riders. If your readers can't wait till 2000 than they are more than welcome to visit our track, which operates Saturdays and Sundays and public holidays from Easter to 9 October 1995.

Happy Steaming,
Lindsay McDonnell
President, BCSME.

Barry Glover is organizing an Australian tour to this event. If you are interested, give him a call on (042) 84 0294.

NZ readers might like to contact the NZ IBLS representative for tour information.

Letterbox Contributions

Contributions of letters by mail to PO Box 136 Robertson NSW 2577 or fax to (02) 646 1362 are very welcome.

As far as possible, AME is an open forum for all members of our hobby. Therefore, all expressions of fact or opinion — as long as they are not libellous — will be considered for publication.

Please **type or clearly print** your letters, as script is often difficult for the typist to interpret.

The Letterbox is becoming a popular medium of expression, so space will be limited. Therefore, letters of 400 words or less will have a better chance of being published.

bmc

News Desk

Compiled by Brian Carter

Welcome aboard to all our New Zealand readers. From this issue AME is being distributed throughout New Zealand by Gordon and Gotch. Our faithful NZ supporter, Murray Lane and his MBM Model Engineering Supplies and Services, will continue to supply AME to customers.

The AMEs bound for New Zealand will sport slightly different cover information to make it "NZ specific". We have always enjoyed a significant NZ content — one that we expect to increase further.

Growth at a price

Our magazine is growing! This issue also sees the print run increased by 1200 copies to make a total of 6000 copies. The extra copies are for NZ distribution and to increase Australian distribution. With your support, AME will continue to grow.

Unfortunately we still hear of readers who are in a line of "sharers". It's not against the law to share magazines so I guess it will continue — at least people are reading AME. To the "sharers": just spare a thought for our AME Crew and authors — all volunteers — who give up their free time, for no payment, to provide you with quality reading. With the help of our loyal advertisers, we have been able to keep the price down to make it easy for everyone to have his/her own copy.

Trade and Commercial

Hobby Mechanics (07) 374 2871 have hundreds of *Model Engineer*, UK, magazines for sale.

AME Retail have just received a new book called *Remember When... The Railways of NSW 1950s Plus*. I saw a copy and it looks good: a full review is being prepared for the July-August AME. Every photo is in full colour! Other new titles include: *Australian Diesel Scene 2* and *Byways of Steam 9* see the advt for pricing details.

Hare and Forbes — NSW readers shouldn't forget the annual four day sale at their George Street Parramatta branch from Thursday 4th to Sunday 7th of May. They promise lots of special deals throughout the sale period.

Metric versus Imperial

If you are thinking about writing something for AME, a word about our policy on mensuration may help alleviate some of the confusion that has been coming through lately.

AME prefers authors to describe all new items in metric units. Of course, if the story is about full-size machinery that was built using imperial units, then imperial units should be used. However, we recognize that most, or many, of our contributors are using imperial tools and may not want to use metrics. To avoid errors, we do not convert articles to metric at the editing stage. Overall, contributors are asked to bear in mind that Australia and New Zealand "went metric" almost a quarter of a century ago; that metric conventions are well established in modern engineering practice; that stock such as tube is metric; and that imperial drills, taps and other tools are becoming more difficult to obtain.

Please avoid mixing measurements in the one story: either keep it *all* metric or *all* imperial.

Articles

We have an acute shortage of cover feature stories. If you have something you think may be of use, we would love to hear from you. We have oodles of help available to make your article easier to prepare.

We also need more Workshop and Technical topics, mainly short ones. I would like to see this part of the magazine expand. Many new modellers can benefit from seasoned modellers' years of experience. When I look back at past issues I marvel at the ingenuity and experience among the model engineering community. If we can get more of it "out of heads, on to paper" we will strengthen our wonderful hobby.

Maritime Matters had no marine news or model boat club information for this issue.

Expo 96 — Otago NZ

We received some news from the organizing committee about this international event to take place over six days from Friday 5th to Wednesday 10th of January 1996.

The activities are centered around the Otago Model Engineering Society facilities and adjacent sports facilities at Kettle Park, Dunedin, NZ.

Club facilities include: large club rooms containing scale railway display areas, workshop, library, members lounge and kitchen facilities; multi gauge raised track and a model boat pond.

Activities will include: multi gauge live steam events; model boat regatta, including steam boats; scale railway displays; traction engine rally; static displays of all facets of modelling and model engineering.

Track specifications: the 800 metre raised track caters for 2½", 3½" 5" and 7¼" gauges, the minimum radius is 13 metres. The track has one tunnel with 1½ metres clearance above the track. The club will ensure that there are enough riding cars to enable up to ten locos operate at any one time.

Travel: The organizing committee has secured concessions up to 15% on normal interisland ferry.

Registrations: To take advantage of interisland ferry discounts you must register by 15 May. All others no later than 31 October 1995.

Enquiries to: Expo Convener
Otago Model Engineering Society
PO Box 2163, Dunedin, 9030, New Zealand.

Stolen Loco

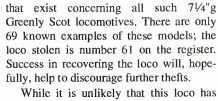
We received a disturbing letter from the Woking Miniature Railway Society Limited, UK.

Mike Smith, the Hon Secretary writes:

Stolen — 7¼" gauge LMS 4-6-0 Royal Scot *Gordon Highlander*.

Sadly, thefts in the model engineering world are becoming all too common. However, this theft is surprising because of the distinctiveness of the loco and the records that exist concerning all such 7¼"g Greenly Scot locomotives. There are only 69 known examples of these models; the loco stolen is number 61 on the register. Success in recovering the loco will, hopefully, help to discourage further thefts.

While it is unlikely that this loco has made its way to Australia or New Zealand, we think that the loco was stolen "to order". It could have gone anywhere and naturally there are many British outline enthusiasts "down under" who could recognize it.



The loco was in working order, being steamed only a few days before its theft. The cladding on the boiler and firebox have yet to be fitted. The tender, cab and running boards are painted green. The smokebox is black and the buffer, red.

The loco is about 9 feet long, weighs about 250kg (5cwt) and the tender at 50kg (1cwt). It has a parallel copper boiler with four rows of superheaters. The whole loco is built to the original Greenly drawings.

A reward of £500 is offered for information leading to its safe return.

If anyone sees or hears anything relating to the theft of this loco, please contact AME so that we can inform the owner.

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  LPR TOOLMAKERS (057) 84 1351

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- Railway, Petrol-Hydraulic loco, built by Willis Eng. W.A. with braked driving car & 3 ride in passenger coaches. 220ft portable track with tandem trailer. $15,800. Phone John on (07) 204 5507

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- Geared head model, not belt driven. Metric calibration, two 3 jaw chucks 5" & 6", one 6" 4 jaw. Face plate, drive plate & driver, 2 steadies, fixed and live centres, 3 angle plates, 4 position tool post. Speeds are from 52 to 1600 RPM 415V power & 240V coolant pump. I have owned this unit from new and it is 7 years old. With it are some assorted tools, tool holders etc. Condition as new. 1 Parts manual with unit, distance between centres 2.0m 510mm Spindle bore 1 1/16" 27mm Price $7,500. Phone (049) 632382 after hours.

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Steam loco in excellent condition, Queensland Rail C17 4-8-0 *Brown Bomber*. $18000 Phone Peter on (07) 881 0512

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